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Research Article

A STUDY OF STUDENTS' MATHEMATICAL PROBLEM-SOLVING SKILL AND SATISFACTION THROUGH MATHEMATICS CAMP ACTIVITY USING SSCS MODEL AND BAR MODEL ON RATIO, PROPORTION, AND PERCENTAGE

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Abstract

The aims of this research were to study of students' mathematical problem-solving skill and satisfaction through Mathematics camp activity using SSCS model and bar model on ratio, proportion, and percentage. The target group was 27 Matthayomsuksa-2 students in the 1st Semester of Academic Year 2021 at Lomsakwittayakhom School, Lomsak district, Phetchabun province obtained by purposive sampling. The experiment spent 17 hours using Mathematics camp schedule and four learning activity plans, the test of mathematical problem-solving skill, the satisfaction survey towards Mathematics camp activity, and the observation form as the research instruments. The data was collected by one-group pretest-posttest design research, then completely analyzed by mean, standard deviation, dependent t-test and for growth score by relative gain score, and record students' behavior by observation during activities.

The studies found that 1) the students' mathematical problem-solving skill after learning is higher than before at .05 level of statistical significance, 2) the average relative gain score of students' mathematical problem-solving skills after learning through Mathematics camp activity using SSCS model and Bar model is at "High" level, and 3) the average score of students' satisfaction after learning through Mathematics camp activity using SSCS model and Bar model is at "Very satisfied" level.

Keywords: Bar Model, Mathematical Problem-solving Skill, Mathematics Camp Activity, Satisfaction, SSCS Model

Introduction

According to the important role of mathematics, it is a part of the development of humans and is fundamental to developing our nation. Mathematics is essential to developing the human mind. It enables a person to think logically and systematically, analyze various problems or situations, anticipate, plan, make decisions, solve problems, and apply mathematics to daily life. Mathematics serves as a tool for learning science, technology, and other disciplines. It is, therefore, beneficial to life, enhancing the quality of life and enabling people to live in harmony (Ministry of Education, 2008). However, previous teaching experiences have revealed that the students' objectives were not accomplished, and students did not perform well enough in solving a mathematical problem in the actual situation because the problem in practice requires a deep understanding of mathematical knowledge that is accurately and clearly expressed. The lack of mathematical problem-solving skills can be in many ways; one of these is that students cannot connect from previous to new mathematical concepts. These happen because students may often memorize mathematical ideas without trying to interpret their idea (Hafiz, et al., 2017).

The SSCS model is the learning model involving students' problem-solving skills. The model helps students to think of reason and solutions to the problems. The SSCS model is based on reasoning and realism. It is created by Pizzini, Sherparson, and Abell (1989); they determined four following steps of SSCS. Step 1: Search (S) - searching the problems and recognizing the causes of the problem. This step consists of brainstorming to distinguish each problem and help students understand the connections of the ideas within the problems. Step 2: Solve (S) - 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. Step 3: Create (C) - the information obtained by problems solving or answering the problems is organized to be more understandable and Step 4: Share (S) - students comment on the others. The answers may be accepted or unaccepted, and the accepted answers may lead to new problems. The unaccepted answer may also lead to new problems when other students find errors in solution planning. The students practice their skills and mathematics process together at the time; within four steps, step 1 (S) and step 2 (S) will encourage students to practice problems solving skills in different contexts to find the answer. Step 3 (C) and step 4 (S), students will practice using language and mathematics symbols to communicate, present, and convey the information correctly.

The Bar model method is a distinctive feature of the Singapore Primary Mathematics Curriculum. It was an innovation in pedagogy by the Ministry of Education, Singapore. The purpose is to raise mathematical competencies and improve problem-solving abilities (Kho et al., 2009). The Singapore Bar Model, also known as the Bar Model, helps students understand the concepts and construct their knowledge. The model method requires students to draw diagrams in the form of rectangular bars to represent known and unknown quantities, as well as the relationships between the quantities. Khairiree (2011) also defined the Bar model as a strategy for solving problems by interpreting the statement from the word problem and linking it to the learner's mathematical analysis idea and then drawing it into boxes or bars form. It enables students to solve problems

efficiently and accurately. Ratio, proportion, and percentage are topics in mathematics related to everyday life, such as mixing ingredients in cooking, beverages, or chemicals, shopping for discounted goods and interest calculation, etc. Therefore, having knowledge and understanding of ratio, proportion, and percentage is important in making decisions correctly and appropriately. Problems found in teaching about ratio, proportion and percentage are problem interpretation and problem solving. These problems arise from students being unable to interpret the problem as a visualization and not associating data relationships that can be assigned. The bar model is another useful technique for solving ratio, proportion, and percentage because it allows students to learn and understand the problem in a concrete way.

Mathematics camps refer to an activity taken as part of the teaching and learning of mathematics outside the classroom or the school. The mathematics camp activity is a temporary gathering of students who come together at a given place and specified time. To do mathematical activities and recreational activities may also be organized. Students can participate in activities together, where they may or may not be staying at a location where the activities consist of academic and recreational activities that include content and mathematical knowledge to enhance knowledge, skills, and experiences in mathematics, including fostering creativity and applying mathematical knowledge gained from doing various activities in daily life. It is also an essential learning-promoting activity that encourages learners to have desirable traits in various areas, especially the key traits that learners should possess and express, such as being critical, self-reliant, realizing the value, and having a good attitude toward mathematics (Mansanguan, 2017).

For the reasons mentioned above, the researcher is interested in studying students' mathematical problem-solving skill through mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage and studying students' satisfaction with learning activities. In this research, the SSCS model is used to design learning activity plans of ratio, proportion, and percentage. While the Bar model is used for devising a plan in solve step of SSCS model.

Research Objective

1. To compare students' mathematical problem-solving skill before and after learning through Mathematics camp activity using SSCS model and Bar model.
2. To study the growth score of students' mathematical problem-solving skill after learning through Mathematics camp activity using SSCS model and Bar model.
3. To study students' satisfaction after learning through Mathematics camp activity using SSCS model and Bar model.

Research Methodology

Research Design

This research is pre-experimental research with a one-group pretest-posttest design, as illustrated in Table 1.

Table 1 One-group pretest-posttest design

Pretest	Treatment	Posttest
O_1	X	O_2

O_1 is the test of mathematical problem-solving skill before the experiment.

X is teaching through Mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage.

O_2 is the test of mathematical problem-solving skill after the experiment.

Participants

The participants of the study were 27 Matthayomsuksa-2 students in the 1st Semester of Academic Year 2021 at Lomsakwittayakhom School. The sample was selected by purposive sampling because students in this classroom are studying in a mini English program (MEP) and have abilities and are familiar with English contexts. Moreover, ratio, proportion, and percentage are one of the mathematics contents that the students have learned by conventional method in the 2nd Semester of Academic Year 2020.

Research Instrument

1. Four learning activity plans which are consisted of 1) introduction to Bar models, 2) ratio and proportion, 3) percentage, and 4) real-world problems related to ratio, proportion, and percentage, during 17 hours of experiment and was evaluated by three experts on the appropriate of 3 components, namely learning activity management, instructional media, and evaluation. The meaning of scoring is as follows: 5 mean the highest appropriate, 4 mean high appropriate, 3 mean appropriate, 2 mean low appropriate, and 1 mean the lowest appropriate. The detail of four learning activities plans using SSCS model and Bar model on ratio, proportion, and percentage is illustrated in Table 2.

Table 2 The detail of four learning activities plans using SSCS model and Bar model on ratio, proportion, and percentage

Learning Activity Plans	Duration (hours)	Evaluation Results from Experts		
		$\bar{x}$	*S.D.*	Level
Introduction to Bar models	5	4.60	0.24	Appropriate
Ratio and Proportion	4	4.70	0.27	Appropriate
Percentage	4	4.44	0.30	Slightly appropriate
Real-world problems related to ratio, proportion, and percentage	4	4.60	0.26	Appropriate

2. The test of mathematical problem-solving skill on ratio, proportion, and percentage, which is consisted of 12 items, was rated on the index of item-objective congruence (IOC) by three experts at 0.67-1.00 and improved the instruments according to the suggestion of the experts by adding a variety of approaches to finding answers that cover all solutions before testing tryout group, 30 students, to measure the quality of the test. Find the difficulty (p), discrimination (r), and reliability of the test from testing with the tryout group. The results show that the difficulty (p) is 0.26-0.79, the discrimination (r) is 0.19-0.52, and the reliability is 0.89. Then, four appropriate items were selected for each pretest and posttest.

The criteria of mathematical problem-solving skill were improved based on the Institute for the Promotion of Teaching Science and Technology (2003) and Polya's process of solving a mathematical problem (Polya, 1957) by each item has a full score of 12 points as illustrated in Table 3.

Table 3 The criteria of mathematical problem-solving skill

Criteria of mathematical problem-solving skill	Score
Step 1: Understand the problem (Ability to understand the problem)	
- Specify correctly what the problem gives and specify clearly what the problem wants to find	3
- Specify correctly what the problem gives but specify unclearly what the problem wants to find **or** Specify partially correct what the problem gives but specify unclearly what the problem wants to find	2
- Specify partially correct what the problem gives but specify unclearly what the problem wants to find **or** Specify incorrectly what the problem gives but specify clearly what the problem wants to find	1
- Specify incorrectly what the problem gives and specify unclearly what the problem wants to find	0
Step 2: Devise a plan (Ability to plan to solve the problem)	
- Correctly define data variables and show the relationship of the data accurately and completely	3
- Do not define variables of data but show the relationship of the data accurately and completely **or** Correctly define data variables but show the relationship of the data partially correct.	2

Criteria of mathematical problem-solving skill	Score
- Do not define variables of data but show the relationship of the data partially correct **or** Correctly define variables of data but show the relationship of the data incorrectly.	1
- Do not define variables of data and show the relationship of the data incorrectly	0
Step 3: Carry out the plan (Ability to solve the problem)	
- Show the step of the solution in a clear sequence and summarize the answers correctly	3
- Show the step of the solution in a clear sequence but summarize the answers incorrectly **or**	2
- Show the step of the solution in a vogue sequence but summarize the answers correctly	
- Show the step of the solution in a vogue sequence but summarize the answers incorrectly **or**	1
- Show the step of the solution in a non-sequence but summarize the answers correctly	
- Show the step of the solution in a non-sequence and summarize the answers incorrectly	0
Step: 4 Look back (Ability to check the result)	
- Show how to check the answer is completely correct	3
- Show how to check the answer is partially correct	2
- There is a trace of mathematical calculations to show how to check the answer but incorrect	1
- There is no trace of mathematical calculations to show how to check the answer	0

3. The satisfaction survey towards the Mathematics camp activity, which is a rating scale of 5 levels consisting of 28 items dividing into 5 categories, namely instructor, contents used in the camp, activities, measurement and evaluation, and benefits, was rated on the index of item-objective congruence by three experts at 0.67-1.00.

4. The observation forms, which are divided into 3 sections: outcomes, problems and obstacles, and solutions.

Data Collection

The researcher collected data with a one-group pretest-posttest design from the following steps.

1. Request permission from the director of Lomsakwittayakhom School for data collection from 27 Matthayomsuksa-2 students in the 1st Semester of Academic Year 2021.

2. Before the experiment, the researcher gave the pretest to the sample group for collecting the students' mathematical problem-solving skill scores.

3. Experiment by following the Mathematics camp schedule and activities and record students' behavior while doing activities.

4. After the experiment, four weeks apart from the pretest, the researcher gave the posttest to the sample group to collect the students' mathematical problem-solving skill scores and do the satisfaction survey after learning through Mathematics camp activity using SSCS model and Bar model.

Data Analysis

The data analysis of this research can be described as follows.

1. Analyze statistical values of the sample's mathematical problem-solving skill from pretest and posttest scores.

2. Find the mean and standard deviation of pretest and posttest scores.

3. Compare the average score of the sample's mathematical problem-solving skill between pretest and posttest scores by dependent t-test.

4. Find the relative gain score of the individual sample's mathematical problem-solving skill using the relative gain score and interpret the relative gain score to the growth score level proposed by Kanjanawasee (2009), as shown in Table 4.

5. Find the mean and standard deviation of the sample's satisfaction with learning activity and interpret the satisfaction level proposed by Srisa-ard (2011) as follows:

4.51 - 5.00 is most satisfied

3.51 - 4.50 is very satisfied

2.51 - 3.50 is moderate satisfied

1.51 - 2.50 is less satisfied

1.00 - 1.50 is the least satisfied

Table 4 The relative gain score to growth score level

Relative Gain Score	Growth score level
76 – 100	Highest level
51 – 75	High level
26 – 50	Intermediate level
0 – 25	Low level

Research Finding

1. The results of a study of students' mathematical problem-solving skill through Mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage can be shown as follows.

Table 5 The mean score ($\bar{x}$) and standard derivation (*S.D.*) of students' mathematical problem-solving skill before and after learning through Mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage

Experiment	N	Total score	$\bar{x}$	*S.D.*	*t*	*p*
Pretest	27	48	27.81	6.98	10.475	0.001*
Posttest	27	48	39.22	4.21		

* p-value < .05

The data in Table 5 shows that the average score of students' mathematical problem-solving skill after learning is higher than before learning, with a level of significant .05.

Table 6 The mean score ($\bar{x}$) and standard derivation (*S.D.*) of students' mathematical problem-solving skill before and after learning through Mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage in four-step of mathematical problem-solving process

Step	Experiment	N	Total score	$\bar{x}$	*S.D.*	*t*	*p*
Step 1: Understand the problem	Pretest	27	12	9.93	1.96	3.749	0.001*
	Posttest	27	12	11.19	0.96		
Step 2: Devise a plan	Pretest	27	12	5.52	2.90	7.162	0.000*
	Posttest	27	12	9.48	1.72		
Step 3: Carry out the plan	Pretest	27	12	6.44	2.67	5.937	0.000*
	Posttest	27	12	9.63	1.47		
Step 4: Look back	Pretest	27	12	5.96	2.78	4.495	0.000*
	Posttest	27	12	8.93	2.59		

* p-value < .05

From Table 6 when comparing the average score of students' mathematical problem-solving skill before and after learned through Mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage in four-steps of mathematical problem-solving process. It shows that the average score of students' mathematical problem-solving skill after learning in each step of mathematical problem-solving process is higher than before learning with a level of significant .05.

2. The results of the relative gain score of students' mathematical problem-solving skill after learning through Mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage, calculated by the relative gain score formula and interpreted to the growth score level. The results of the data analysis show that the range of the relative gain score is between 31.58 and 94.74. There are three levels of students classified by growth score level: intermediate level 11 students, high level 13 students, and highest level 3 students. The average relative gain score of students' mathematical problem-solving skill after learning through Mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage is 56.51, with growth score at a high level. The highest relative gain score is 94.79, with growth score at the highest level, while the lowest relative gain score is 31.58, with growth score at the intermediate level.

3. The results of students' satisfaction after learning through Mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage show that the range of the average score is between 4.63 and 4.96, and the average score of students' satisfaction after learning through Mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage is 4.81 at the most satisfied level.

The highest average score is item no. 28: I have practiced listening and accepting the opinions of others, while the lowest average scores are item no. 9: I am satisfied with the interesting content and item no. 10: I am satisfied with the quantity of content.

Conclusion and Discussion

According to the research results, the discussion can be considered by the following three aspects.

1. To compare students' mathematical problem-solving skill before and after learning through Mathematics camp activity using SSCS model and Bar model.

The results of the study of students' mathematical problem-solving skill before and after learning through Mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage. The study found that students' mathematical problem-solving skill after learning is higher than before learning through Mathematics camp activity using SSCS model and Bar model at 0.05 levels of significance where the average score of the pretest is 27.81 or 63.20 percent and posttest is 39.22 or 89.14 percent. Solving mathematical problems requires understanding the steps or processes of solving problems in sequence. It must choose a suitable technique for each problem situation as well. The researcher proposed a bar model technique to help plan solutions, one of Polya's four-step problem-solving processes. These include understanding the problem, devising a plan, carrying out the plan, and looking back. To enable students to learn and solve problems according to Polya's problem-solving processes, as mentioned above. Students have learned through the SSCS model and Bar model. Therefore, students have the following developments at each step:

Step S (Search), students are faced with a problem presented by the teacher where the teacher is there to help and ask questions so that students can clarify problems and not get confused when facing complicated problems. Students have practiced understanding problems, correctly specifying what the problem gives, and clearly specifying what the problem wants to find through questions, giving examples, and various assignments.

Step S (Solve), students need to understand the problem, plan a solution using the bar model method presented, lead to the correct resolution, and check the answer. This step will depend on the ability of the individual. Students may be able to solve problems with shortcuts or in a language that they only understand and receive the answer. Student have practiced solving the problems using bar model from basic to advance problems. The studied found that students have ability to plan to solve the problem, ability to solve the problem, and ability to check the result higher than before.

Step C (Create), students need to create a work piece to show them easy steps to communicate to others to understand their problem-solving processes by creating new pieces or re-work the solved step with a sequence of steps so that others can become easily understandable. Students at this camp created work pieces in both individual and group assignments. Students have pleasure and gain confidence at this step since they can re-check their work and collaborate on a work piece with group members.

Step (Share), students will demonstrate ideas and exchange mathematical solutions they have created to get the correct answers and suitable solutions for others. Each student has the opportunity to present their work to group members as well as other groups. Students comment on each other and respect one the other's ideas.

The four steps are a process that allows students to study and practice independently, enable students to organize their ideas and plan a systematic problem-solving, learn how to help each other, and accept each other's opinions corresponded to Abell and Pizzini (1992) studied on the effect of a problem by SSCS model learning management on the classroom behaviors and attitudes of grades 5–8 students. The study discovered that students participated well in classroom and changed better behavior on their responsibility. SSCS problem-solving learning management is learning management that allows students to interact between teachers and students and more between students and students. Enhance students' participation, which is a behavior that is necessary for working in groups to solve problems for the above reasons, when the instructor provides learning management through the SSCS model and bar model for students to practice mathematical problem-solving. When students have the opportunity to solve the problem by themselves and the instructor assists students in their problem-solving, establishes a nonjudgmental environment, and provides interesting activities, it enables students to solve the problem orderly and do not give up when struggling in their problem-solving. Moreover, they can communicate what they did with others. Corresponding with Samaiyoo (2011) studied about effects of organizing SSCS model on mathematical problem-solving and communication abilities of Matthayom Suksa two students on the application of linear equation in one variable, and Kaewnasang (2019) studied mathematical problem-solving ability after learning through SSCS model together with Team-Pair-Solo technique at Kannasootsuksalai School, Suphanburi province which had the same results by students' mathematical problem-solving skill was higher than before learning by SSCS model. It can be concluded that the results of the learning activities through the mathematics camp activity using the SSCS model and bar model can make students' problem-solving skill higher than before, which follows the hypothesis.

2. To study the growth score of students' mathematical problem-solving skill after learning through Mathematics camp activity using the SSCS model and the Bar model.

The study on the growth score of students' mathematical problem-solving skill after learning through Mathematics camp activity using SSCS model and Bar model by using the relative gain score and interpret growth level from the test of mathematical problem-solving skill from both pretest and posttest. The research found that students have a growth level at the highest level of 3 people or about 11.11 percent, students have a growth level at a high level of 13 people or approximately 48.15 percent, and students have a growth level at an intermediate level of 11 people or approximately 40.17 percent. The average growth score of students' mathematical problem-solving skill is 56.51. Therefore, their level of development is at a high level compared with previous knowledge and experience. The results of comparing the average score of students' mathematical problem-solving skill before and after learning through Mathematics camp activity using SSCS model and Bar model on ratio, proportion, and percentage in four steps of mathematical problem-solving

process is higher than before learning with a level of significant .05. According to the results above and observations during activities, students have developed their mathematical problem-solving skill in four steps of mathematical problem-solving process as follows:

In step 1: Understand the problem (Ability to understand the problem), students perform well at this step. The result shows that the average score after learning is slightly higher than before learning. This step provides them with being able to understand the problems. After learning through the camp, most students can correctly specify what the problem gives and correctly specify what the problem wants to find.

In step 2: Devise a plan (Ability to plan to solve the problem), students have the most outstanding development in this step because they have the most significant difference in scores before and after learning. Since the students have learned the bar model technique, students can interpret the problem and write the bar model to represent the data, leading to the next step of solving the problem. After examination, it was found that 74.07 percent of students used the bar model technique to plan and solve problems. Most students can show the relationship of the data accurately.

In step 3: Carry the plan (Ability of solving problem), students can show the solution step in a clear sequence and summarize the answer correctly after planning to solve the problem by drawing a bar model in step 2.

In step 4: Look back (Ability to check the result), most students can show how to check that the answer is entirely correct. Some students can show how to check that the answer is partially correct, and some cannot show it at all.

Results of learning through mathematics camp activity using the SSCS with bar model make the interaction between students and students, including students and instructor, students' awareness, intention, and understanding of contents. Group discussion and learning from practice and facing the problem themselves affect their knowledge and skills, promote further development, and receive higher scores. Corresponding to Kanchanawasee (2009) stated that learning development arises from experiences organized by teachers. Learners change quantity or quality, knowledge, ability, behavior, or mental characteristics in a desirable direction and from the research of Kaday (2016) studied about the effect of open approach with SSCS model that affecting the achievement of science, the ability to solving problem and instructional satisfaction of the student grade 10. The studies discovered that students' development improved by a mean of 55.20, indicating that they are progressing at a high level.

3. To study students' satisfaction after learning through Mathematics camp activity using SSCS model and Bar model.

A study on students' satisfaction after learning through Mathematics camp activity using SSCS model with the Bar model found that the students' satisfaction was at the highest level. Corresponding with students' recommendations in the satisfaction survey that the students commented on such as "I think the teachers convey their knowledge very well and I would like to have a camp like this for the juniors every year. Thank you very much", "It was so much fun. It makes me understand more from what I have studied

before", "This mathematics camp is enjoyable," and "I want the bar model method to be taught in mathematics subject at school." From the comments, we will see that students who have learned through Mathematics camp activity using SSCS model and Bar model make learners feel fun in learning and have a positive attitude towards learning mathematics.

From a previous study on the level of satisfaction in each component. It was found that satisfaction with the instructor was 4.81, satisfaction with contents used in the camp was 4.68, satisfaction for activities was 4.78, satisfaction for measurement and evaluation was 4.85, satisfaction on benefits was 4.84, of which all student components had an average of 4.81 at the highest level. This is described as follows:

As for the instructor component, it was found that the students had the highest level of satisfaction because learning management through Mathematics camp activity using SSCS model and Bar model is learner-centered learning management by teachers encourage and reinforce to keep students motivated to study. Leading questions are used to create an analytical thinking process, and it also allows students to solve problems on their own.

As for the contents used in the camp component, it was found that the students had the highest level of satisfaction because the content of ratio, proportion, and percentage is content that students have learning before, which is appropriate in both quantity and attractiveness.

As for the activities component, it was found that the students had the highest level of satisfaction. Due to the order of activities and the mathematics camp activities. There is interaction within and between groups, and the learning materials used to teach are interesting and easy to learn. Students are satisfied with the SSCS learning management model with the bar model because they have demonstrated their full potential.

As for the measurement and evaluation component, it was found that the students had the highest level of satisfaction because learners were involved in both their own and group activities. Students evaluate their work and others. As a result, students intend to develop their work in every activity to come out the best.

As for the benefits component, it was found that the students' satisfaction was at the highest level because students practiced their skills in solving mathematical problems using the bar model, which is a method that students have never studied before. It helps them solve problems, making it easier to understand the content being studied. They have practiced being more confident and accepting the opinions of others.

Therefore, the study results on students' satisfaction after learning through Mathematics camp activity use the SSCS model and Bar model in each component. The students' satisfaction after learning through Mathematics camp activity using the SSCS model and Bar model was at the highest level. Corresponding with the research of Lapawae (2016) studied about organizing learning activity for problem-solving development by Polya's problem-solving process co-operate with Bar model for second grade students, Kaday (2016) studied about the effect of open approach with SSCS model that affecting the achievement of science, the ability to solving problem and instructional satisfaction of the student grade 10, and Naksanga (2018) studied about the developing mathematical learning achievements and skill in solving fraction equations of grade 6 students

through the integration of the inquiry learning cycle (7E) with the Bar model by the studies found that the students' satisfaction were high level after the experiment.

Recommendations

Recommendation for Future Study

1. The researcher suggested studying the SSCS and Bar model on other topics such as linear equation. The purpose is to study on students' learning mathematics achievement and problem-solving skill.

2. The researcher suggested that the SSCS model and other techniques should be studied to develop mathematical creativity skill. Due to learning management of SSCS model in solve step, students may be able to use various techniques for solving mathematical problems.

General Recommendation

1. The SSCS model is a learner-centered learning management, instructors need to provide students the opportunity to search, solve, create, and share the problems by themselves. Instructors should encourage and guide students to think critically and solve problems on their own.

2. Instructors should design additional time to introduction to the Bar models plan because students may be unfamiliar with it. Students may require additional time to learn and connect the ideas of the Bar model technique for solving mathematical problems.

3. Instructors should create a camp environment that differs from learning in classroom with fun and exciting environment, provide positive reinforcement by setting goals or group missions and fostering a competitive culture, but students are not under pressure.

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