

Development of Mathematics Problem Solving Ability by Using the Problem Solving Model of Metacognitive Process of Grade 11th Students

Wilawan Chantowat, Mahasarakham University, Thailand
Montri Thongmoon, Mahasarakham University, Thailand

The Asian Conference on Education & International Development 2018
Official Conference Proceedings

Abstract

The proposes of this study were 1) to develop the students' mathematics problem solving ability in order to pass the criteria of 70 percent of full score. The target group was 21 students of grade 11th students in academic year 2017 from Sarakhampittayakhom School, Muang, Mahasarakham. The research methodology is classroom action research which consists of four cycles. The research instruments were: 1) 11 lesson plans of the problem solving model of metacognitive process, 2) Mathematics problem solving ability test, and 3) the interview form. The data was analysed by using mean, percentage, and standard deviation. The results were as follows: The students' mathematics problem solving ability mean scores in the first, the second, the third and the fourth cycle were 55.23, 60.47, 71.76 and 78.89 percent respectively. It obviously be seen that the students' mean score passed the criteria in the third cycle.

Keywords: Mathematics Problem Solving, Metacognitive Process, Thailand

iafor

The International Academic Forum
www.iafor.org

Introduction

Mathematics is a methodical application of matter. It is so said because the subject makes a man methodical or systematic. Mathematics makes our life orderly and prevents chaos. Certain qualities that are nurtured by mathematics are power of reasoning, creativity, abstract or spatial thinking, critical thinking, problem-solving ability and even effective communication skills. Although mathematics is an important and essential part of humanity. However, the current state of teaching and learning has not been as successful. Obviously, the results of the Ordinary National Educational Test (ONET) in Mathematics of grade 12th student in 2016. The national average score was 24.88 from 100. It's lower than the benchmark 50 percent (National Institute of Educational Testing Service, 2017). In addition, From Trends in International Mathematics and Science Study 2015 (TIMSS 2015) show that the average score of ability in mathematics of Thai's students was 431, it was 26th of 39 country. It indicated that Thai's student has low level of mathematical ability as compared with international students. This may be due to several reasons. One of the reasons is: Students fail to read and understand problems. Cannot calculate accurately. And students lack understanding, process or solution. Therefore problem solving is the primary purpose of mathematics and problem solving is a process skill that is at the heart of mathematics instruction.

From interviews with students studying mathematics of grade 11th in academic year 2017 from Sarakhampittayakhom School, Thailand. It was found that most students could not solve problems. In addition, the results of the survey were used to measure the ability to solve math problems found that the mean score of Mathematics reasoning ability test was 58.51 percent. The results indicated that the number of students who under criteria score were 21.

The Problem Solving Model of Metacognitive Process developed from from polya's problem solving process. There are 5 step 1) Engagement: Initial confrontation and making sense of the problem. 2) Transformation-Formulation: Transformation of initial engagements to exploratory and formal. 3) Implementation: A monitored acting on plans and explorations. 4) Evaluation: Passing judgments on the appropriateness of plans, actions, and solutions to the problem. 5) Internalization: Reflecting on the degree of intimacy and other qualities of the solution process plans. (Yimer and Ellerton). Each step will focus on Metacognition. Self-control Recognize the process of thinking. This will allow students to develop better mathematics problem solving abilities.

As above, the researcher used the problem solving model of metacognitive process in the class of mathematics learning activities develop the students' mathematics problem solving ability in order to pass the criteria of 70 percent of full score.

Research Purpose

The purpose of this study was to develop the students' mathematics problem solving ability in order to pass the criteria of 70 percent of full score.

Sample

The samples was 21 students of grade 11th students in academic year 2017 from Sarakhampittayakhom School in Thailand.

Research Instruments

The instrument in this research was the 1) 11 lesson plans of the problem solving model of metacognitive process, 2) Mathematics problem solving ability test, and 3) the interview form.

Procedure

In this research is the Action Research, Researcher have conducted research using the problem solving model of metacognitive process in the lesson plan with learning activities with grade 11th students. To development Mathematics problem solving ability. There are 4 cycle in the research. Each cycle is as follows:

Step 1 Plan: 1) The researcher had studied the level of mathematics problem solving ability of grade 11th students. 2) The researcher created a lesson plan by using the problem solving model of metacognitive process 11 lesson plan and Mathematics problem solving test 4 collection. Step 2 Action: The researcher using lesson plan by using the problem solving model of metacognitive in learning activities. Each cycle consists of different content. Step 3 observe: The researcher collected the data by allowing the students to do a Mathematics problem solving test after completing the learning activities in each cycle and interviewed students with a score lower than 70%. Step 4 Reflect: The Researcher evaluated the test, compared to 70%. Analyst interviews after each cycle, created and improve lesson plans to use in the next cycle.

After that the data were analyzed and conclusion.

Results

The results of the analysis of the mathematics problem solving ability of grade 11th students By using the problem solving model of metacognitive in learning activities for development Mathematics problem solving ability in order to pass the criteria of 70 percent of full score. The students' mathematics problem solving ability mean scores in the first, the second, the third and the fourth cycle were 55.23, 60.47, 71.76 and 78.89 percent respectively. The data were shows in Table 1.

Table 1: Average score (\bar{x}), Standard deviation (S.D.) of total score Mathematics problem solving ability of 21 students from the Mathematics problem solving ability test.

No.	Total score for Mathematics problem solving.							
	1st cycle		2nd cycle		3rd cycle		4th cycle	
	Percentage. (100)	Evaluation.	Percentage. (100)	Evaluation.	Percentage. (100)	Evaluation.	Percentage. (100)	Evaluation.
1	88.89	Passed	88.89	Passed	91.77	Passed	94.44	Passed
2	55.56	Not pass	61.11	Not pass	80.56	Passed	83.33	Passed
3	52.78	Not pass	44.44	Not pass	55.56	Not pass	72.22	Passed
4	63	Not pass	61.11	Not pass	72.22	Passed	83.33	Passed
5	52	Not pass	52.78	Not pass	55.56	Not pass	80.56	Passed
6	33.34	Not pass	55.56	Not pass	61.11	Not pass	75	Passed
7	36.11	Not pass	47.22	Not pass	55.56	Not pass	72.22	Passed
8	52.78	Not pass	52.78	Not pass	58.33	Not pass	75	Passed
9	80.56	Passed	83.33	Passed	88.89	Passed	75	Passed
10	61.11	Not pass	55.56	Not pass	61.11	Not pass	100	Passed
11	61.11	Not pass	61.11	Not pass	69.44	Not pass	88.89	Passed
12	38.89	Not pass	41.66	Not pass	47.22	Not pass	75	Passed
13	30.56	Not pass	58.33	Not pass	91.67	Passed	72.22	Passed
14	38.89	Not pass	47.22	Not pass	58.33	Not pass	58.33	Not pass
15	69.44	Not pass	75	Passed	86.11	Passed	75	Passed
16	55.56	Not pass	72.22	Passed	86.11	Passed	86.11	Passed
17	47.22	Not pass	52.77	Not pass	58.33	Not pass	58.33	Not pass
18	69.44	Not pass	75	Passed	86.11	Passed	91.67	Passed
19	69.44	Not pass	72.22	Passed	88.89	Passed	88.89	Passed
20	58.33	Not pass	61.11	Not pass	83.33	Passed	75	Passed
21	47.22	Not pass	52.78	Not pass	61.11	Not pass	75	Passed
\bar{x}	55.23	Not pass	60.47	Not pass	71.76	Passed	78.89	Passed
S.D	15.26	-	12.80	-	14.97	-	10.56	-

The results of the analysis percentage of mean score each step of the mathematics problem solving ability of grade 11th students By Polya's four-step approach (G. Polya, 1957) to problem solving included Understand the Problem, Devise a plan, Carry out the plan and Look Back. The data were shows in Chart 1.

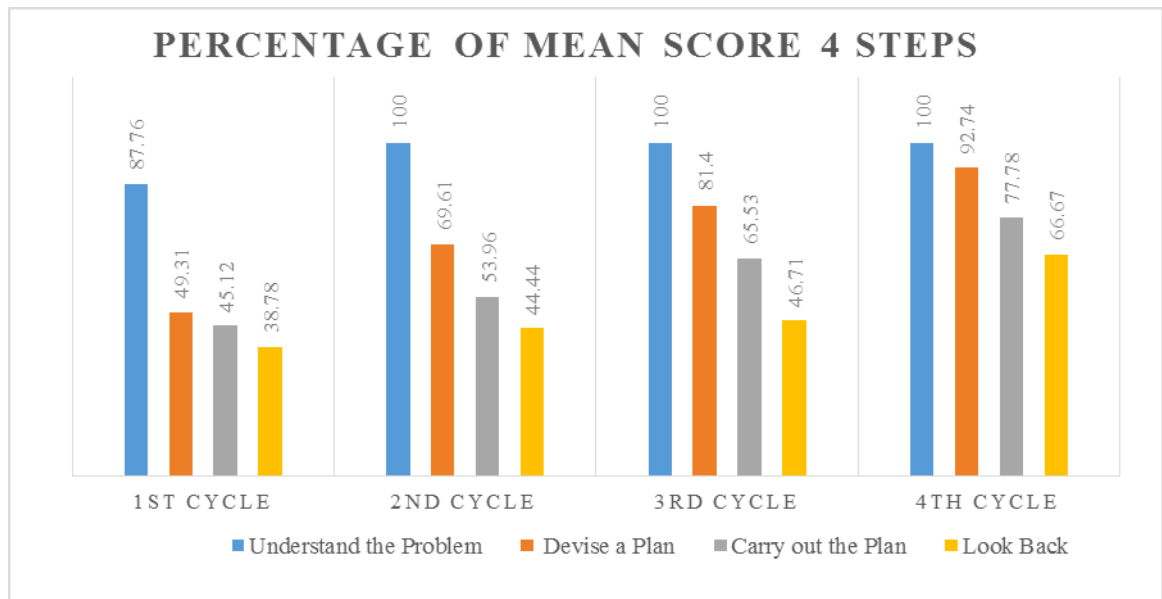


Chart 1: Percentage mean score of total score Mathematics problem solving ability 4 steps of 21 students from the Mathematics problem solving ability test.

Conclusion

According to the study of the students' Mathematics problem solving ability, It was found that the table 1 shows that The average student pass score was 70% in the third cycle. Notice that in the third cycle and the fourth cycle shows students have consistently increased Mathematics problem solving scores. In addition, it was found that there are two students who have not passed the Criteria included student No.14 and student No. 17. The study found that they could not solve the problem. The process of finding the answer includes the basis for the calculation. This is a weakness so students cannot solve the problem. From chart 1, although the ability of students in each circle. It will increase continuously. However, it is clear that the score at the Look Back step is the lowest in every cycle.

Therefore the Mathematics problem solving must be done step by step when students are unable to complete the first step, so students will not be able to complete the next step. Students cannot find answers or incorrect answers. So student learning by using the Problem Solving Model of Metacognitive Process (Yimmer and Ellerton) can develop the Mathematics problem solving ability of Grade 11th Students.

Acknowledgements

I would like to thank the Institute for the Promotion of Teaching Science and Technology for providing funding to support this research.

Recommendation

This research describes about the level of the scientific concepts understanding of only grade 11th students in Sarakhampittayakhom School, Thailand.

References

Trends in International Mathematics and Science Study; TIMSS. (2015)
<http://timssthailand.ipst.ac.th/timss/reports/2015>

National Institute of Educational Testing Service ; NIETS . (2560). *The basic statistics of the O- NET exam grade 6, 9 and 12 of the academic year 2016 (100 points)*.retrieved 4 september 2017
<http://www.newonetestresult.niets.or.th/AnnouncementWeb/School/ReportSchoolBySchool.aspx?mi=2>.

Polya, G. (1957). *How to solve It : A New Aspect of Mathematic Method*. New York: Doubleday and company.

Yimer, A., and Ellerton, N. F. (2006). *Cognitive and Metacognitive aspects of Mathematical Problem Solving: An Emerging Model*. Identities, cultures, and learning space, 575-582.

Contact email: wilawan.beer@gmail.com