Analyzing Difficulties in Problem Solving of the Polygon Area for Elementary Students

AHMAD NIZAR RANGKUTI[1]

Abstract

Mathematics is part from a human activity; it cannot be separated from daily human life, both in theory and in practice. Problem solving is the most important topic in learning Mathematics. However, problem solving is a complex process that has many components. One of them is the difficulty of students in answering the questions about how to find the area of polygon. Students are hard to find out two or more shapes contained in polygon. The students are hard to find unknown measurements, because they do not understand the questions. Therefore, teachers should give guidance to the students in order to help them to solve problems correctly. The purpose of this study was to analyze students' difficulties to solve the problems of the polygon area questions for the fourth grade of one state elementary in Padang Sidimpuan City. There were 33 participants consisting of 16 male and 17 female students. The students were given a problem solving test and the questions were related to a wide area of polygon consisting of five questions. The findings of the study indicated that students were hard to find solutions to solve mathematical problems of the polygon area flat shapes in class, suggesting that teachers should strive to develop students' critical thinking as well as creative thinking so they will have a good problem solving skills.

Keywords

Polygon, problem solving, student difficulties

1. Tarbiyah and Teacher Training Faculty, IAIN Padangsidimpuan, North Sumatra, Indonesia; nizarahmad1304@iain-padangsidimpuan.ac.id

Introduction

Mathematics is a subject matter that is closely related to human daily activities. Mathematics comes from the real world of humans and will be useful for human life. Many activities cannot be separated from mathematics. It requires mathematics to be taught to students as early as possible in order to keep up with the competition in the era of technological and information development as it is today (Syaiful et al., 2019).

Problem solving is an important thing in mathematics. It has a complex process and components (Çeziktürk et al., 2019; Syaiful et al., 2019). Finishing mathematical tasks with problem solving has principle differences. Students are only asked to be able to provide answers, when finishing mathematical tasks, whereas the problem in mathematics is if the process requires reasoning, predicting, searching for formulas and the answers cannot be obtained directly. One of the characteristics of a problem is that if solving the problem requires reasoning / thinking, challenging students to presume or predict possible solutions, by having a single non-answer and it can be proven that the answer is correct. Thus, the critical thinking skills possessed by students are demanded to be better.

Critical thinking is the activity of analyzing an idea in an increasingly specific direction, being able to distinguishing, identifying, reviewing and developing it into further perfect direction (Wujiati et al., 2019). Problem is a situation where someone wants to take action to get what he wants.   Syaiful et al. (2019) that problem solving is a process that is carried out in a planned manner so that problems can be overcome. Problem solving is a kind of process that created to solve a problem. Lestari and Mokhammad (2015) mention that the problem-solving ability, namely the ability of students to solve routine, non-routine, non-applied routine and non-applied non-routine problems in mathematical subject matters. Routine problems mean problems which are solved by repetitive algorithms. Non-routine problems mean new problems that need to be solved in planning, solving, and not just using formulas, and theorems. Applied routine problems mean problems that are related to the real life of students. Routine non-applied problems mean the problem is related to the real world which is solved using an algorithm. Applied non-routine problems mean problems where the solution is required to plan to make connections to the real world. Non-applied non-routine problems are a problem that is closely related to the relationship of mathematics solely.

Many learning theories have been designed in the implementation of the mathematics learning process; one of them is Vygosky's theory (Danoebroto, 2015). He states that learning can occur effectively and efficiently if one student learns cooperatively with other students in a supportive situation and environment, which is certainly guided by the teacher or adult people. In mathematics, constructivism has done a lot about research, application and testing in different class situations and conditions. From the results of research, the application and testing of these experiments have produced a variety of perspectives that also contribute to the development and innovation of learning, especially mathematics. The purpose of this study was to analyze students' difficulties to solve the

problems of the polygon area questions for the fourth grade of one state elementary in Padang Sidimpuan City.

Literature Review: Problem Solving in Math

Problem solving holds a particular meaning in the study of mathematics. A main aim of mathematics teaching and learning is to build the ability to solve a wide-ranging variety of complex mathematics problems. To be a good problem solver in mathematics, individual must develop a basis of mathematics knowledge. Silver (1979) found that successful problem solvers were more possible to classify mathematics problems on the base of their fundamental similarities in mathematical structure. Problem solving is a significant activity in teaching mathematics as the capability to solve problems gotten in mathematics teaching can commonly be shifted to be used in solving other problems (Bell, 1978).

Also, according to Rahayu (2008), problem solving is a process of thinking as an effort to find a problem and solve it based on information collected from various sources so that an appropriate conclusion can be drawn. Additionally, Wahyudin (2003) states that problem solving must be an integral part of the teaching process as they teach. Schoenfeld (1979) specifies that competent mathematics students may have difficulties in doing what may be considered basic mathematics for their level of achievement.

Furthermore, Ruseffendi (1988) states that problem solving consists of five steps that must be done, namely (1) presenting the problem in a more distinctively form, (2) stating the problem in an operational form, (3) arranging alternative hypotheses and work procedures that are estimated well to solving the problem, (4) testing hypotheses and doing work to get results (data collection, data processing, etc.), the results may be more than one, and (5) re-checking whether the results obtained are correct or not, maybe also choose the best solution. In addition, Polya (1957), problem solving consists of four main steps, namely (1) understanding the problem, (2) making a plan / carry out settlement, (3) carrying out the plan / reckoning, and (4) re-checking.

Additionally, problem solving is needed if someone wants to solve a problem but don't know how to solve it clearly (Ruseffendi, 1988; Silver, 1979; Syaiful et al., 2019). The ability to solve problems is very important to be known by the students in order to avoid the difficulties in solving problems, especially solving problems in wide area of polygon tasks. The obstacle that is often experienced by students when they want to find out the solutions to solving wide area of polygon is that the students hard to find the two shapes contained in the polygon. In addition students are difficult to find out unknown measurements, because they do not understand the problems and it could say that they need teachers' guidance from the beginning till the end to do their task properly.

Methodology

This study was to analyze students' difficulties to solve the problems of the polygon area questions for the fourth grade of one state elementary in Padang Sidimpuan City. The participants in this study were all of the students of the fourth grade of one state elementary in Padang Sidimpuan City. There were 33 participants with 16 male and 17 female students.

All of the participants were voluntarily willing to participate in the study. The students were given a problem solving test and the questions which were related to a wide area of polygon consisting of five questions. The test was given in order to measure their ability to solve the problems. The questions were made in the form of contextual tasks. The questions were in the form of contextual questions. Furthermore, to make the instrument better, firstly the grill instrument was arranged into problem solving instrument items of polygon.

Before questions were given to all participants, all were validated by mathematic education experts and mathematics teachers. This process was done in order to make sure that all questions were appropriate for the level of participants in order to achieve the purpose of the study which was to analyze students' difficulties to solve the problems of the polygon area questions for the fourth grade of one state elementary in Padang Sidimpuan City. Additionally, this study set the indicators of problem solving capability as indicated in the following table.

Table 1. *Indicators of problem solving capability*

Aspects	Measurement indicators	Question Number
Understanding the problem	• Write down what is understood • Write down logical reasons	
Planning a solution	• Write down mathematical equation models and ways of solving that can be used in a problem	
Calculating	• Carry out the plans that have been made and prove if the steps that have been chosen are correct	1 s/d 5
Re-checking	• Re-checking the settlement, doing the test again or trying the answers • Check work related to calculations and analysis • Checking for work related to completeness or lack of clarity	

Findings and Discussion

High-level mathematical thinking skill is needed by students. The ability to think a high-level of mathematics must have an impact on students related to the ability to solve

problems (problem solving) in daily life. Mathematical thinking skills consist of critical thinking skills as well as creative thinking, problem solving skills, and analytical skills. The ability to think critically as an ability that should be mastered by students for every level in schools ranging from elementary to high school (Regulation of the Minister of Education and Culture Republic of Indonesia Number 21 Year 2016 About High School Content Standards, 2016). The content standard requires that critical thinking skills must be possessed by students. It is known that the ability of students to think critically will be able to finish or solve mathematical problems. Through critical thinking skills students are expected to be able to learn and provide solutions to any problems faced systematically and originally.

This indicates that the importance of the ability of critical thinking to solve problems. Therefore, students must be equipped with the ability to think critically as much as possible in order to have the maximum problem-solving ability which can be done through mathematical activities in accordance with the learning objectives of each mathematics subject matter.

This expectation is not in accordance with the reality. It was found at the location that the problem solving abilities of students still varied from the ability of the high category to the low category. The results of tests conducted in this study revealed that there were still many students who received low grades. The acquisition of low scores was the result of students' critical thinking skills that have not yet developed as expected as Schoenfeld (1979) states that capable mathematics students may have problems in doing what may be considered basic mathematics for their level of achievement.

The low ability to solve mathematical problems of students can be seen from the acquisition of students' answers when doing mathematical problems which were still unsatisfactory. When given questions related to polygon area building to all 33 students, most of them obtained unsatisfactory results. These results are in line with Silver (1979) found that successful problem solvers were more possible to classify mathematics problems on the base of their fundamental similarities in mathematical structure. The results can be in the following table regarding the result of a math test for the materials of polygon area building with a total of 5 questions.

Table 2. *The results of a test of the area of polygon*

No.	Students' Code Number	Score	No.	Students' Code Number	Score
1	001	40	21	021	90
2	002	30	22	022	50
3	003	20	23	023	30
4	004	70	24	024	30
5	005	70	25	025	30

Table 2. *The results of a test of the area of polygon… (continued)*

6	006	70	26	026	20
7	007	80	27	027	80
8	008	80	28	028	100
9	009	70	29	029	20
10	010	60	30	030	10
11	011	60	31	031	10
12	012	50	32	032	20
13	013	50	33	033	70
14	014	60	Total: 1820		
15	015	60	Average: 55,15		
16	016	60			
17	017	80			
18	018	80			
19	019	80			
20	020	90			

From the table 2, it can be seen clearly that only 1 students got the highest score (100) with the code number of 028, and there were 2 students who got 90, with a code numbers of 020,021, and 6 students got 80 with a code number of 007,008,017,018,019,027, 5 students got 70 with the code number of 004,005,006,009, and033. Furthermore, 2 students got the score 10 and it was below the Minimum Mastery Criteria (KKM) for the polygon material with the code 030,031, and the students who had a score of 20. There were 4 students who got a score of 30 with a code number of 002,023,024,025, only 1 students who got 40 with a code number of 001, the students with a score of 50 as many as 3 students whose code numbers were 012,013,022, students who had a score of 60. There were 5 students with a code number of 010,011,014,015,016. The following figure shows a histogram of the test results on the area of polygon.
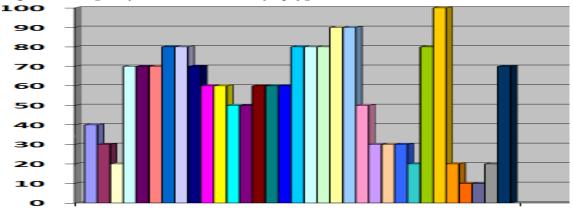
Figure 1. *Histogram of mathematics test results for polygon area*

Furthermore, it could be seen from table 3 that there were questions that were difficult for students to work on.

Table 3. *The results of the test of the polygon area which are difficult to do by the students*

No.	Questions' Number	Total students	Category
1	1	7 students	Wrong
		26 students	Correct
2	2	18 students	Wrong
		15 students	Correct
3	3	20 students	Wrong
		13 students	Correct
4	4	22 students	Wrong
		11 students	Correct
5	5	31 students	Wrong
		2 students	Correct

It could be seen from the table, the question number 4 was to be the most difficulty one to be answered by the students. As many as 22 students made mistakes when answering math problems and only 11 students could answer correctly, for question number 5, there were 31 students that answered it wrongly while 2 students who correctly answered the question. So, it could be concluded that students were hard to find solutions to solve mathematical problems of the polygon area flat shapes.

Conclusion

The correct mathematical problem solving according to the problem solving procedure is one of the difficult parts for students. The study looked at students' difficulties to solve the problems of the polygon area questions for the fourth grade of one state elementary in Padang Sidimpuan City. Many students considered it difficult to find solutions to solve mathematical problems, especially for the polygon area flat shape. School-age children are the potential and effective age to develop. The students in the fourth grade who are between eleven to twelve years old are having a concrete operational level; it means that in the learning process, children can be explored and developed their potential by using concrete objects.

Through the results of this study, it is expected that teachers always strive to develop students' critical thinking as well as creative thinking so they will have good problem solving skills. The learning process should use concrete objects to provide interpretations and understandings for students and followed by the abstract concepts. The findings of the study

suggest that teachers should be active in exploring and developing students' critical thinking and creative thinking.

Additionally, teachers should encourage students to follow a general problem solving procedure by asking their students to read the problem carefully. The first and most essential step is to read the problem carefully to understand what their students are asked to find out and what information their students have been given. Then, providing their students with a strategy and make sure that their strategy is actually answering the question.

References

Bell, F. H. (1978). *Teaching and learning mathematics in secondary school*. New York: WC Brown Company Publisher.

Çeziktürk, Ö., İnce, S., Yalim, G., Karadeniz, K., & Kenar, Z. (2019). Making a Rhombicosidodecahedron: Mathematical Thinking Revisited. *IRJE (Indonesian Research Journal in Education)*, *3*(1), 120-140. https://doi.org/10.22437/irje.v3i1.4865.

Danoebroto, S. W. (2015). *Teori belajar konstruktivis Piaget dan Vygosky. Indonesian Digital Journal of Mathematics and Education, 2*(3), 191–198.

Lestari, K. E., & Mokhammad, Y. (2015). P*enelitian pendidikan matematika*. Bandung: PT. Refika Aditama.

Rahayu, S. (2008). *Analisis kemampuan siswa dalam memecahkan pada sub konsep pencemaran lingkungan melalui metode studi kasus. Bandung*. UPI

Ruseffendi, E.T. (1988). *Pengajaran matematika modern dan masa kini untuk guru dan calon guru*. Bandung: Tarsito.

Schoenfeld, A. H. (1979). Can heuristics be taught? In J. Lockhead, Cognitive process instruction. Philadelphia, PA: Franklin Institute Press.

Silver, E. A. (1979). Student perceptions of relatedness among mathematical verbal problems. *Journal for Research in Mathematics Education, 10*(3), 195-210.

Syaiful, Muslim, Huda, N., Mukminin, A., & Habibi, A.(2019). Communication skills and mathematical problem solving ability among junior high schools students through problem-based learning. *International Journal of Scientific & Technology Research, 8*(11), 1048- 1060.

Wahyudin. (2003). *Peranan problem solving*. Bandung: PPS UPI Bandung.

Wujiati, Toho Cholik Mutohir, Nining W. Kusnanik, Zukhairina, Sri Hidayati, Emosda, Ekawarna, Yennizar, Amirul. Mukminin. (2019). Critical thinking skills based– physical activities learning model for early childhood. *The Journal of Social Sciences Research,5* (3), 738-755.

Biographical notes

AHMAD NIZAR RANGKUTI is a faculty member at Tarbiyah and Teacher Training Faculty, IAIN Padangsidimpuan, North Sumatra, Indonesia; nizarahmad1304@iain-padangsidimpuan.ac.id