

Efforts to Improve Analytical Thinking Abilities in Mathematics Learning: *Problem Solving Learning Model*

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Abstract: This study aims to describe (1) the use of problem solving methods by mathematics teachers in debate learning in class VIII B. (2) student responses to the use of problem solving methods in mathematics learning in class VIII B. (3) teacher obstacles that come from students in the use of problem solving methods in mathematics learning in class VIII B SMPN 3 Numfor Barat. This study uses a quantitative descriptive research design. The subjects of this study are teachers and student. The objects in this study are the use of problem solving methods, student responses, and teacher obstacles. The data collection methods used are observation methods and interview methods. The data in this study were analyzed descriptively quantitatively. The conclusions of this study are (1) the use of problem solving methods has been effective and in accordance with procedure. (2) student responses are mostly positive. (3) the obstacles found by teacher are in terms of student and very limited school facilities. The suggestion of this study is for mathematics teacher to maintain the effectiveness of learning and motivate students more, and for school to improve learning facilities.

Keyword : Problem Solving, Analytical Thinking, Mathematics

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Introduction

Mathematics is one of the branches of science that is often encountered in everyday life. Every activity in various fields can always be associated with mathematics. Mathematics is always studied at every level of education. Mathematics is also one of the subjects tested in the national exam. Therefore, efforts are needed to develop the quality of mathematics learning to improve students' mathematical abilities.

Mathematics is a subject that requires high thinking in learning it. One of the goals of learning mathematics is to improve students' thinking skills. Students' thinking skills that are quite important to develop are analytical thinking skills. This is in accordance with the explanation of the Ministry of National Education (2006:139) that Mathematics subjects need to be given to all students starting from elementary school to equip students with logical, analytical, systematic, critical, and creative thinking skills, as well as the ability to work together.

Development analytical thinking skills are needed to meet the demands of learning development. Learning development from time to time is always carried out to improve the quality of education and improve the quality of learning outcomes. In the 21st century there is a shift in the learning paradigm .

The characteristics of 21st century learning are information (available anytime, anywhere), computing (faster using machines), automation (reaching all routine work), and communication (from anywhere to anywhere). In the automation section, learning is directed to train analytical thinking (decision making) not mechanistic thinking (routine) (Kemendikbud, 2012).

Analytical thinking skills are often used in everyday life. Analytical thinking skills are used primarily to determine a decision. Good decisions certainly come from proper problem analysis. Jonassen (2003: 17) states that analytical skills including problem solving skills are very much needed to solve problems, both complex, structured and unstructured. Therefore, analytical thinking skills need to be developed.

Dennis Adams & Marry Hamm (1994:17) stated that "analyzing skills is classifying and examining information of components and relationships". A mathematical problem needs to be divided and analyzed into parts which are then searched for their relationships to be solved sequentially and orderly. Analytical thinking skills according to Bloom are divided into 3 categories, namely: a) *Differentiating : learning to determine the relevant or important pieces of message*. b) *Organizing: the ways in which the pieces of a message are configured* . c) *Attributing : underlying purpose of the message* . (Richard E. Mayer , 2002:230)

Based on the results of observations at SMP Negeri 3 Numfor Barat , the learning process is still centered on the teacher or teacher centered. In addition, students' analytical thinking skills in mathematics are still lacking. This can be seen in the learning process, namely the majority of students often ask the teacher about what a problem means and what steps must be taken to solve it. The results of these observations indicate a lack of students' analytical thinking skills. Difficulty in describing problems indicates a lack of students' ability to classify information from the problem, while difficulty in determining the steps for solving shows that students have not been able to organize and determine the relationship of each piece of information in the problem so that the steps for solving the problem cannot be known.

Efforts to improve analytical thinking skills can be done by using the right learning method. One method that can be used is problem solving. The problem solving method is a way of presenting lessons by encouraging students to find and solve a problem or experiment in order to achieve teaching goals (Hamdani, 2011: 84). Furthermore, the steps in problem solving according to Polya (Daniel Muijs & David Reynolds, 2006: 120) are: 1) Understanding and representing the problem, 2) Selecting or planning the solutions, 3) Executing the plan, 4) Evaluating the result. These steps are in line with aspects of analytical thinking skills. So the problem solving approach can be used as an effort to improve analytical thinking skills.

The use of a problem solving approach to improve students' analytical thinking skills is supported by several relevant studies. In his research on the use of the problem solving approach to improve analytical thinking skills in mathematics learning , he concluded that the problem solving method is able to improve analytical thinking skills.

Here are some previous studies related to improving analytical thinking skills in mathematics learning with problem-solving learning models: (1) Research by Polya (1973), Problem Solving Approach. This study emphasizes four stages of problem solving, namely understanding the problem, planning a solution, implementing the solution, and reviewing. The results show that this approach can help students understand mathematical concepts better. (2) Research by Schoenfeld (1985), Mathematical Problem Solving. Schoenfeld examined how problem-solving strategies can improve students' critical and analytical thinking skills in solving mathematics problems. He found that

students who were given problem-solving strategy training performed better in analyzing mathematics problems. (3) Research by Hudojo (2005), Problem-Solving-Based Mathematics Learning. Hudojo examined the effectiveness of problem-solving-based learning in improving students' conceptual understanding and analytical thinking skills. The results showed that this model was more effective than conventional methods. (4) Research by Suherman (2010), Use of Problem-Solving Learning Models in Improving Critical Thinking. In his research, Suherman found that students who were taught with a problem-solving model had better critical and analytical thinking skills than students who learned with the lecture method.

Differences with This study aims to further explore how the problem-solving learning model can specifically improve students' analytical thinking skills in mathematics learning. Compared to previous studies that focused more on problem solving in general, this study highlights: a) Specific strategies in the problem-solving model that are most effective in improving analytical thinking skills. b) Comparison with other learning methods to assess their effectiveness in more depth. c) Analysis of students' analytical thinking skills before and after the application of the problem-solving learning model.

Thus, this study provides a new contribution by adding a more specific perspective on the role of the problem-solving model in improving students' analytical thinking skills in mathematics.

Based on the description above, it can be seen that students' analytical thinking skills need to be improved. One effort to improve analytical thinking skills is to use a problem solving approach.

Methodology

Research Approach and Type

This study uses a quantitative approach with a quasi-experimental method. This type of research was chosen to see the effectiveness of the problem-solving learning model in improving students' analytical thinking skills in mathematics learning.

Research Design

The research design used is Nonequivalent Control Group Design, where there are two groups of students: a) Experimental group, which is given learning with a problem-solving model. b) Control group, which is given learning with conventional methods. Both groups will be given a pre-test and post-test to measure the improvement in their analytical thinking skills.

Population and Sample

Population: Junior high school (SMP) or senior high school (SMA) students who are studying certain mathematics materials. Sample: Taken using a purposive sampling technique, namely selecting two classes that have relatively the same level of academic ability based on the results of previous exams.

Research Instruments

The instruments used in this study include: a) Analytical thinking tests, in the form of math questions that measure logical thinking, systematic thinking, and problem solving skills. b) Observation sheets, to assess student activity during learning. c) Interviews and questionnaires, to collect data on student responses to the learning model applied.

Data Collection Techniques

Data were collected through the following stages: a) Pre-test was given to both groups before treatment to measure initial analytical thinking skills. b) Implementation of learning, where the experimental group was given learning with a problem-solving

model, while the control group was given a conventional method. c) Observations were made during the learning process. d) Post-test was given after treatment to measure the improvement of students' analytical thinking skills. e) Interviews and questionnaires were given to students to find out their opinions about the learning that was applied.

Data Analysis Techniques

Descriptive Statistical Analysis, to see the difference in the average results of the pre-test and post-test. Normality Test and Homogeneity Test, to ensure that the data meets statistical assumptions. t-test (Independent Sample t-Test), to find out whether there is a significant difference between the experimental group and the control group in improving analytical thinking skills.

Success Indicators

The success of this study was measured based on: a) Increase in post-test scores of students in the experimental group compared to the control group. b) Student activity in learning, based on observation sheets. c) Positive student responses, based on the results of questionnaires and interviews. This methodology is designed to ensure that the research results can validly and reliably demonstrate the effectiveness of the problem-solving learning model in improving students' analytical thinking skills in mathematics.

Result and Discussion

Result

Thinking ability is one aspect that needs to be improved in learning, especially in mathematics learning. This is supported by the explanation of the Ministry of National Education (2006:139) that Mathematics subjects need to be given to all students starting from elementary school to equip students with logical, analytical, systematic, critical, and creative thinking skills, as well as the ability to work together.

David R. Krathwohl (2002:215) states " *analysis as breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose* ". Based on this understanding, there are several aspects in analytical thinking, namely breaking down problems into parts, determining the relationship/relationship of the parts, and using the relationship between parts to achieve goals.

One way to improve analytical thinking skills is with a *problem solving approach* . According to Cooney, teaching students to solve problems allows students to be more analytical in making decisions in life (Herman Hudojo, 2001: 167). In addition, aspects of analytical thinking are in line with the steps in *problem solving* . The first step in the *problem solving approach* is to understand and describe the problem. This can improve aspects of analytical thinking because in describing the problem students can distinguish/identify information from a problem. The second step is to determine the steps for solving, this stage can improve one aspect of analytical thinking, namely correlating parts of information that have been known because in the stage of determining the steps for solving, knowledge is needed about the correlation between parts of information that have been known. Furthermore, in *problem solving*, the plan is implemented. This can improve one aspect of analytical thinking, namely directing to the goal of the problem because by implementing the problem solving plan, the goal of the problem can be achieved.

Each cycle consists of four types of actions, namely: planning (*plan*), action (*act*), observation (*observe*), and reflection (*reflect*). The four types of actions can be described as follows:

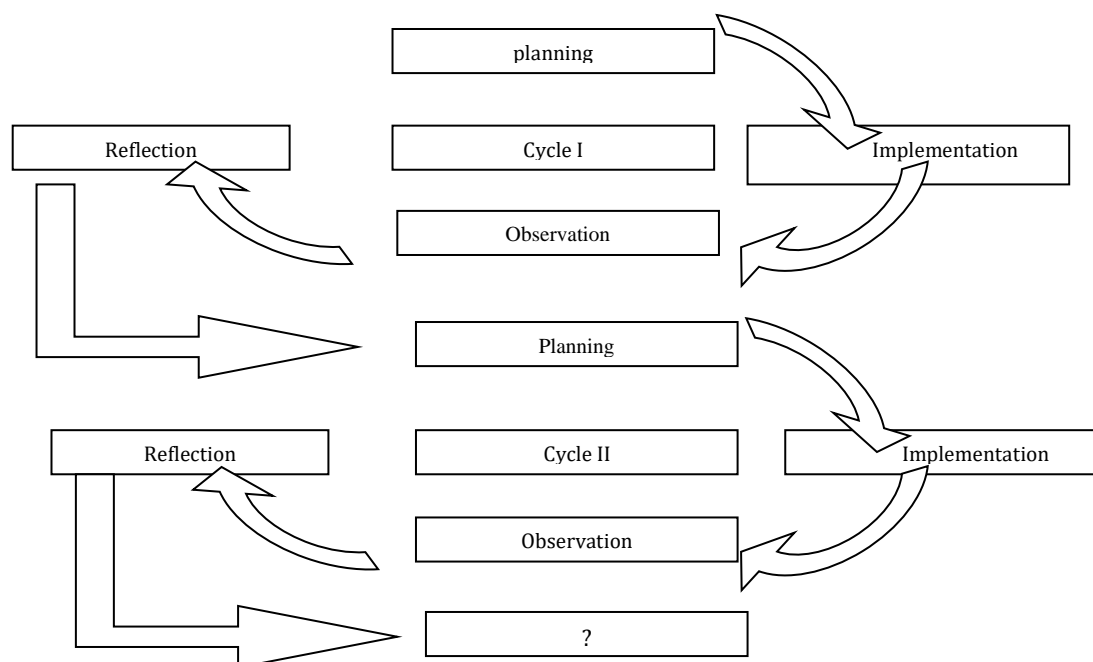


Figure 1 spiral model of classroom action research (Suharsimi Arikunto, 2006:16)

If the results obtained in the first cycle are not ideal, then subsequent cycles are carried out until the results obtained are ideal in accordance with the research objectives.

Table 1 Classification criteria for analytical thinking skills

Percentage	Information
$67\% < p \leq 100\%$	Good
$33\% < p \leq 67\%$	Currently
$0\% < p \leq 33\%$	Not enough

This table shows the classification of analytical thinking skill levels based on the percentage of student achievement. Here is an explanation of each category:

1. $67\% < p \leq 100\%$ (Good)
 - a. If the percentage of student achievement in analytical thinking is within this range, then their ability is considered good.
 - b. Students in this category are able to identify problems, analyze conceptual relationships, develop solution strategies, evaluate solutions, and draw conclusions well.
 - c. They demonstrate a strong understanding of mathematical concepts and are able to apply problem solving effectively.
2. $33\% < p \leq 67\%$ (Currently)
 - a. Students in this category have moderate (sufficient) analytical thinking skills.
 - b. They may be able to complete some aspects of problem solving but still have difficulty in certain steps, such as evaluating solutions or drawing logical conclusions.
 - c. More practice or guidance is needed to improve their skills.
3. $0\% < p \leq 33\%$ (Not Enough)
 - a. Students in this range have low analytical thinking skills.
 - b. They have difficulty in identifying problems, understanding conceptual relationships, and developing solution strategies.

- c. Further intervention is needed, such as additional guidance or more effective learning methods, to improve their analytical thinking skills.

This table is useful for evaluating the effectiveness of learning and determining the intervention strategies needed to improve students' analytical thinking skills in mathematics learning.

Table 2 Scoring guidelines for student response questionnaires

Alternative answers	Positive statement (+)					Negative statement (-)				
	SS	S	R	TS	STS	SS	S	R	TS	STS
Score	4	3	2	1	0	0	1	2	3	4

Column Description:

- SS (Strongly Agree)
- S (Agree)
- R (Undecided/Neutral)
- TS (Disagree)
- STS (Strongly Disagree)

Explanation of Scoring Method:

1. Positive Statement (+)

- If the student Strongly Agrees (SS) with a positive statement → score 4
- If the student Agrees (S) → score 3
- If the student is Undecided (R) → score 2
- If the student Disagrees (TS) → score 1
- If the student Strongly Disagrees (STS) → score 0

2. Negative Statement (-)

- If the student Strongly Agrees (SS) with a negative statement → score 0
- If the student Agrees (S) → score 1
- If the student Undecided (R) → score 2
- If the student Disagrees (TS) → score 3
- If the student Strongly Disagrees (STS) → score 4

Purpose of Using This Table: a) This table is used to convert responses students into numerical scores in the questionnaire data analysis. b) Positive statements measure aspects of student support for the learning method, while negative statements measure student disagreement with certain aspects. c) The final score can be calculated by adding up the values of all statements for each student. d) The higher the total score, the more positive the student's attitude toward the learning applied. This table ensures that scores are given consistently, especially when there are positive and negative statements in the questionnaire.

Table 3 Student response criteria

Presentation	Response criteria
75% - 100%	Very good
50% - 74.99%	Good
25% - 49.99%	Enough
0% - 24.99%	Not good

This table is used to classify the level of student response based on the percentage of questionnaire results that have been converted into a numeric score.

1. 75% - 100% (Very Good)
 - a. If the results of student responses are in this range, it means that students are very positive about the learning method used.
 - b. They feel that the learning method is helpful, interesting, and effective in improving understanding.
2. 50% - 74.99% (Good)
 - a. Students show a positive response, although there are still some aspects that may not be optimal.
 - b. Most students like the learning method but there may be a few obstacles that need to be fixed.
3. 25% - 49.99% (Enough)
 - a. Student responses to learning are sufficient, but there are still many shortcomings.
 - b. Some students may feel that the learning method is less effective or less interesting.
4. 0% - 24.99% (Not Good)
 - a. Student responses to learning are negative.
 - b. Most students feel that the learning method is less helpful, boring, or does not suit their needs.

Purpose of Using This Table: a) To interpret the results of the student response questionnaire quantitatively and qualitatively. b) Assess the effectiveness of the learning model applied in the study. c) Become a basis for improving or repairing learning methods based on student feedback. by using this table, researchers can see whether the problem-solving learning method is well received by students or requires improvement.

Discussion Study

Learning according to Slameto (2010:2) is a process of effort carried out by someone to obtain a new change in behavior as a whole, as a result of his own experience in interaction with his environment. This opinion is in line with the opinion of Howard L. Kingskey who stated "*learning is the process by which behavior (in the broader sense) is originated or changed through practice or training*". (Syaiful Bahri Djamarah, 2002:13)

Behavioral changes can be characterized by several things. According to Slameto (2010:2) the characteristics of behavioral changes in the sense of learning include: a) Changes occur consciously. b) Changes in learning are continuous and functional. c) Changes in learning are positive and active. d) Changes in learning are not temporary. e) Changes in learning are purposeful or directed. f) Changes cover all aspects of behavior

In learning, there are certainly goals to be achieved. One of them is increasing ability as an output of learning outcomes. According to Robert M. Gagne, there are 5 types of learning outcome abilities: a) Intellectual skills. b) Cognitive strategies, regulating a person's way of learning and thinking in the broadest sense including problem-solving abilities. c) Verbal information, knowledge in the sense of information and facts. d) Motor skills. e) Attitudes and values (JJ Hasibuan & Moedjiono, 2002:5)

Thus, learning is important because learning can influence a person's way of thinking in addition to the various other benefits that can be obtained.

Learning

Learning according to Sudjana (Sugihartono, 2007:80) is every effort made intentionally by educators that can cause students to carry out learning activities. Another opinion states that learning is a process carried out by individuals to obtain a new change

in behavior as a whole, as a result of the individual's own experience in interaction with their environment. (Educational science development team, 2007:137)

Biggs (Sugihartono, 2007:80) divides the concept of learning into 3 meanings, namely: a) Learning in a quantitative sense is Quantitatively, learning means the transmission of knowledge from teacher to student. In this case, teachers are required to master the knowledge they have so that they can convey it to students as well as possible. b) Learning in an institutional sense is Institutionally, learning means the arrangement of all teaching abilities so that they can run efficiently. In this sense, teachers are required to always be ready to adapt various teaching techniques for various students who have individual differences. c) Learning in a qualitative sense is Qualitatively, learning means the teacher's efforts to facilitate student learning activities. In this case, the role of teachers in learning is not just to cram knowledge into students, but also to involve students in effective and efficient learning activities.

Meanwhile, according to John AK (2002:4) learning consists of three parts: a) Cognitive learning is learning about facts, knowledge, and information. Examples: learning about economics, mathematics, social problems, and so on. b) Affective learning is learning by paying attention to emotions, feelings that are developed and expressed. Examples: discussions and tests based on student group appreciation. c) Picomotor learning is learning that includes physical properties, increasing physical activity abilities. Examples: batik practice, making candles, and so on .

Learning is an effort made by teachers to implement learning activities for students. In the learning process, three stages are needed, namely preparation, implementation and evaluation. Good learning needs to use the right method for maximum learning activity achievement.

Mathematics Learning

Mathematics is important to learn. Mathematics is a universal science that underlies the development of modern technology, has an important role in various disciplines and advances human thinking power (Depdiknas, 2006:139). The objectives of learning mathematics include the following: a) Understanding mathematical concepts, explaining the relationship between concepts and apply concepts or algorithms, flexibly, accurately, efficiently, and precisely, in problem solving . b) Using reasoning on patterns and properties, performing mathematical manipulations in making generalizations, compiling evidence, or explaining mathematical ideas and statements . c) Solving problems that include the ability to understand problems, design mathematical models, solve models and interpret the solutions obtained . d) Communicating ideas with symbols, tables, diagrams, or other media to clarify situations or problems . e) Having an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, attention, and interest in studying mathematics, as well as a persistent and confident attitude in problem solving. (Ministry of National Education, 2006:140) .

Mathematics subjects need to be given to all students starting from elementary school to equip students with logical, analytical, systematic, critical, and creative thinking skills, as well as the ability to work together (Depdiknas, 2006:139). Analytical thinking skills are one aspect supported by mathematics learning. Therefore, mathematics learning can be done as an effort to improve analytical thinking skills.

Analytical Thinking Skills

Thinking is an activity that is always done by everyone. John Dewey & Wertheimer (Syaiful Bahri Djamarah, 2002:34) view thinking as a process. Meanwhile, according to John W. Santrock (2011:79) thinking is manipulating and managing or transforming information in memory. Furthermore, Syaiful Bahri Djamarah (2002:35) states that there

are various levels of thinking, namely the level of knowledge, comprehensive, application, analysis and synthesis, evaluation. The types of thinking work taught at the analytical and synthetic thinking levels are thinking to describe and combine.

Classification of thinking in the cognitive domain by Bloom includes: knowledge, comprehension, application, analysis, synthesis, and evaluation (WS Winkel, 2012: 273). The analysis stage includes the ability to detail a unit into parts, so that the overall structure or organization can be well understood (WS Winkel, 2012: 274). Furthermore, in the revision of Bloom's taxonomy according to David R. Krathwohl (2002: 215) states "*analysis as breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose*". While Dennis Adams & Marry Hamm (1994: 17) state that "*analyzing skills are classifying and examining information of components and relationships*". So analytical thinking is a way of thinking by dividing or breaking down problems into parts and determining their relationships.

Bruce Joyce & Marsha Weil (1980: 40) stated "*the procedure for analyzing concepts in unorganized materials involves: a) Locating the concepts. b) Identifying the attributes used. c) Discussing the adequacy and appropriateness of the attributes. d) Comparing the examples to other passages using the same concepts. e) Generally, progression to analyzing concepts in unorganized materials is part of sequence of instruction in concept attainment activity.*"

Bloom divides the analysis aspects into 3 categories, namely: *a) Differentiating: learning to determine the relevant or important pieces of message* (differentiating: learning to determine the relevant or important pieces of a message). *b) Organizing: the ways in which the pieces of a message are configured* (organizing: the way in which the pieces of a message are arranged). *c) Attributing: underlying purpose of the message* (connecting: the main reason underlying the purpose of the message) (Richard E. Mayer, 2002:230).

Jonassen (2003: 17) stated that analytical skills including *problem solving skills* are very much needed to solve problems, both complex, structured and unstructured. In addition, learning is directed to train analytical thinking (decision making) not mechanistic thinking (routine) (Kemendikbud, 2012). So analytical thinking needs to be developed as a goal of learning activities, as well as in terms of its usefulness in everyday life.

Based on the various understandings and opinions, the indicators of analytical thinking ability in this study are: a) The ability to identify problems and information from a question. b) The ability to show the relationship/relationship of the parts that have been identified. c) The ability to solve problems according to the relationship/relationship of each part to achieve the goal of the question.

Problem Solving Learning Model

The problem-solving approach is a focus in mathematics learning which includes closed problems with a single solution, open problems with non-single solutions, and problems with various ways of solving (Ministry of National Education, 2006:139).

The definition of a problem according to Hiebert (John et al, 2010: 33) is "*any task or activity for which the students have no prescribed or memorized rules or methods, nor is there a perception by students that there is a specific 'correct' solution method*".

Furthermore, according to Polya, there are 2 problems in mathematics: a) Problems to find, can be theoretical or practical, abstract or concrete, including puzzles. b) Problems to prove are to show that a question is true or false, not both (Herman Hudojo, 2001: 164)

Dewey's concept (Syaiful Bahri Djamarah, 2002: 34) about thinking becomes the basis for problem solving: a) There is a difficulty that is felt and awareness of the existence of a problem. b) The problem is clarified/limited. c) Searching for information/data and

then the data is organized. d) Searching for relationships to decide on hypotheses, then the hypotheses are assessed, tested so that they can be accepted/rejected. e) Application of solutions to the problems faced and at the same time serves as a test of the truth of the solution to be able to reach a conclusion .

Problem solving is an important thing to master. According to Herman Hudojo (2001:170) problem solving is an essential thing in teaching mathematics because: a) Students become skilled at selecting relevant information then analyzing it and finally re-examining the results. b) Intellectual decisions will arise from within which are an intrinsic reward for students. c) Students' intellectual potential increases. d) Students learn how to make discoveries through the process of making discoveries.

According to Cooney, teaching students to solve problems allows students to be more analytical in making decisions in life (Herman Hudojo, 2001: 167). This is supported by the opinion of Marilyn Burns (2000: 19) "*students benefit from learning about problem solving procedures that are useful for analyzing and solving problems*" .

These opinions are complemented by Hamdani (2011: 85) who stated that the advantages of the *problem solving method* are: a) Training students to design an invention . b) Thinking and acting creatively . c) Solving problems faced realistically . d) Identifying and conducting investigations . e) Interpreting and evaluating observation results . f) Stimulating the development of students' thinking progress to solve problems faced appropriately . g) Can make school education more relevant to life, especially the world of work .

the problem solving approach with analytical thinking skills is shown by the steps in *problem solving* that are in accordance with the aspects of analytical thinking skills. Depdiknas (2006: 139) states that to improve problem solving skills, it is necessary to develop skills in understanding problems, making mathematical models, solving problems, and interpreting solutions. Various other opinions regarding the steps taken in the *problem solving approach* include Stephen Krulik & Jesse AR (1995) who state "*The heuristic of the problem solving process is: a) Read and think : In this heuristic, the problem is analyzed. The facts are examined and evaluated. The question is determined. b) Explore and plan : At this stage, the problem solver analyzes the data and determines whether there is sufficient information . c) Select a strategy : Considered by many people to be the most difficult heuristic of all. A strategy is that part of the problem solving process that provides the direction the problem solver should take in finding the answer . d) Find the answer : The appropriate mathematical skills are employed to find an answer . e) Reflect and extend : The answer or answers must be checked for accuracy to see if the initial conditions of the problem have been met and if the question has been answered correctly*" .

According to Shelly Frei (2008 : 123) "*These four steps will enable students to tackle problems in a structured and meaningful way: a) Understanding the problem. Selecting the information they know and deciding what is unknown will help them begin to see how to solve the problem . b) Planning and communicating solutions. students should decide how they would solve the problem by thinking about the different strategies that could be used . c) Reflecting and generalizing. Many times the solutions and strategies in one problem can help students know how to solve another problem. d) Extensions. Students need practice in internalizing it*" .

The steps in the *problem solving approach* according to Polya (John et al, 2010:35) include: a) *Understanding the problem. Figuring out what the problem is about, identifying what question or problem is being posed . b) Devising plan. Thinking about how to solve the problem . c) Carrying out the plan. Implementation of the plan . d) Looking back.*

The steps in the *problem solving approach* generally have the same process. In this study, the researcher chose Polya's steps that are in line with aspects of analytical thinking skills. This can be seen in the first activity, namely understanding the problem. This can be marked by identifying the problem. The second activity is thinking about a plan, in accordance with the second aspect of analytical thinking skills, namely determining the relationship/relationship of the parts. Then the third activity is carrying out the problem solving plan, this is in accordance with the third aspect of analytical thinking skills, namely determining problem solving by utilizing the relationship of each part.

problem solving learning approach requires the role of teachers in its implementation. In this case, the teacher plays a role in guiding students to carry out *the problem solving steps*. The steps that must be taken by teachers in the *problem solving learning approach* according to Polya (1973: 6-15) include: a) Understanding the problem, The teacher asks students several questions to direct students to understand the problem, including: Try reading the previous question again, What is not yet known from the question?, What data is contained in the question?, What is the situation described by the question?, State the question in a picture and provide information about the parts that are known and unknown. b) Determining a plan includes Do you know the problem related to the question?, Examine the part asked, are there any problems that are often encountered that are similar to the question?, Have you ever encountered a similar question before? Can you solve it?, Can you restate the question in your own words?, If you have not been able to solve the question, try solving the problem related to the question, Can you use the data that is already known to solve the question?. c) Carrying out the plan includes Pay attention to the steps you use, are they correct?, Show that your steps are correct. d) Rechecking includes Can you check the results?, Can you check the reasons?, Are the results you get different?, Try to recheck your work briefly, Can you use the results/methods for other problems?.

The delivery of these questions is adjusted to the context of the questions given. Learning can also be carried out with the help of LKS (student worksheets) which guide students to solve problems using *problem solving*.

Conclusion

The success indicator is the basis for knowing the success of the research that has been conducted. In this study, the success indicators are as follows: a) Students' analytical thinking ability is generally more than 60% or included in the good and very good criteria . b) The *problem solving* approach is implemented in learning, indicated by the percentage of implementation of *the problem solving approach* reaching at least 80% . c) Students are said to provide a positive response to mathematics learning using the *problem solving approach* if the percentage of student responses reaches the good or very good criteria (minimum percentage of 50%).

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