APPLICATION OF DISCOVERY LEARNING MODELS WITH HEURISTIC APPROACH (CRULIC AND RUDNIC) TO IMPROVE THE STUDENTS MATHEMATICAL PROBLEM-SOLVING SKILLS

Reni Mustika Nugraheni[a], Uus Kusdinar[b]
Program Studi Pendidikan Matematika Universitas Ahmad Dahlan
Jalan Ring Road Selatan, Tamanan, Banguntapan, Bantul Yogyakarta
[a]mesyastevaniputri@gmail.com ,[b] uus.kurdinar@pmat.uad.ac.id

ABSTRACT

The approach to learning mathematics used in class X of SMA Negeri 1 Prambanan 2018/2019 academic year is still not encouraging students to take an active part in learning activities, allegedly to be one of the causes of the lack of students' mathematical problem-solving skills. This study aims to improve mathematical problem-solving skills by applying the Guided Discovery Model with the Krulik and Rudnick Heuristic Approach to the inequalities of two variables. This type of research is Clas Action research Research (CAR). This study's subject was students of class X Science Mathematics (MIPA) 4 State Senior High School (SMA Negeri) Prambanan 1 the Academic year 2018/2019 with 32 students. Simultaneously, the object in this study is the whole process of applying the Guided Discovery Model with the Krurik and Rudnik Heuristic Approach. Data collection techniques are carried out through student observation techniques, interviews, and documentation. Instrument data collection in the form of observation sheets, the completion of practice questions of students' mathematical problem-solving skills, and the results of interviews. Test instruments are used in the form of validation. Technical data analysis uses descriptive methods. This study's results indicate that applying the Guided Discovery Model with the Heuristic Approach Type Krulik and Rudnik can improve students' mathematical problem-solving skills. The improvement of students 'mathematical problem-solving skills can be seen from the average results of completing the practice questions of students' mathematical problem-solving skills from the Low category with 29.34% in the first cycle to Very High 80.816% in cycle II.

Keywords: Problem-Solving Skills, Guided Discovery, Heuristic Approach types Krulik and Rudnik

INTRODUCTION

Quality humans are inseparable from education. Education plays a vital role in creating intelligent, creative, skilled, responsible, productive, and moral human beings. Education is not just about delivering the media, but it is a robust social institution to develop into a quality person. Education is one aspect of life that must receive more attention from the community to become a better person than before. Learning is the primary process that can help students get the knowledge to fit the learning objectives. Knowing students' characteristics becomes the principal capital of an educator in preparing teaching materials, situations, and learning methods so that learning objectives can be adequately conveyed and correctly.

Mathematics is a symbolic language whose practical function is to express quantitative relations and spaces, while the theoretical function is to facilitate thinking. Johnson and Myklebust 1967 in Abdurrahman (2003: 525). Based on these functions, mathematics is a science that is very important and becomes one of the other essential knowledge. Mathematics is inseparable from reasoning and structure because it arises from human thought directly related through process and reasoning. Therefore, mathematics learning is developed to train students to solve mathematical problems to solve everyday life problems. Some students are still less active based on observations in the field in mathematics learning activities in class. They are still dependent on the teacher's explanation. As a result, many students already understand and understand the concepts that have been delivered by educators. However, if faced with a problem presented in a different form, they still experience difficulties.

Based on observations in class, students still have difficulty understanding the questions and changing them in mathematics. This continues to the inability of students to decide the resolution of problems. As a result, students lack working on math problems that contain problems and find solutions to them. Based on SMA Negeri 1 Prambanan's observations, the researchers concluded that students had difficulty solving mathematical problems because mathematical problem-solving skills in turning problems into mathematical models were still lacking. Students seem to follow mathematics learning well, but students find it difficult when faced with solving new forms and required to solve them. Based on an interview with Mr. Windarto as one of the mathematics teachers in SMA Negeri 1 Prambanan on October 3, 2018, he said students tend to understand concepts well. However, if they are confronted with math problems in different forms, students find it difficult to solve them. This results in students feeling dependent on solving math problems. This feeling of dependency will suppress students' skills in solving a problem.

Therefore, most of the students' mathematical grades are still below the Minimum Completeness Criteria (MCC); it is seen in table 1. Based on the description in Table 1, the authors intend to research the title The Implementation of Guided Discovery Models with a Heuristic Approach of Rudiment and Rudnic Type to Improve Problem Solving Skills Mathematics of Class X Students SMA Negeri 1 Prambanan in Academic Year 2018/2019.

Table 1. Mid-Semester Grade X Grade Odd Semester SMA Negeri 1 Prambanan Semester 2018/2019

Class	Many students reach ≥MCC (75)	Many students reach <MCC (75)	Total students
X IPA 1	7	25	32
X IPA 2	11	21	32
X IPA 3	8	21	29
X IPA 4	3	29	32

The reason researchers chose the guided discovery learning model with the Krulik and Rudnik heuristic approach because the research conducted by Andika Prastowo in Nupita (2013) concluded that learning by applying the guided discovery model can improve students' problem-solving skills. Also, Zulfah (2017) also conducted a study entitled The Effect of the Application of Cooperative Learning Models of Think Pair Share Types with a Heuristic Approach to the Mathematical Problem-Solving Ability of Students in Naumbai District of Kampar District. The study results stated that applying the Cooperative learning type Think Pair Share with Heuristic approach has increased the students' mathematical problem-solving ability. According to Ruseffendi in Karim (2011), the method (teaching) of discovery is a teaching method that regulates teaching. The child obtains knowledge that he did not know before but not through notification partially or wholly found himself. The advantages of guided discovery learning models are students learn how to learn (learn how to learn) self-respect, motivate themselves, and are easier to transfer, minimize or avoid memorization (Cairin in Satyawati: 2011). Satyawati (2011) concluded that the guided discovery learning model's weakness is for specific materials. The remaining time is longer; not all students can follow the lesson well; not all topics are suitable to be conveyed by this method.

The steps of the guided discovery learning model According to Sanjaya (2008: 192-193) are as follows: (1) Orientation/observation to find the problem, (2) Formulate the problem, (3) Formulate a hypothesis, (4) Plan problem solving, (5) Collecting data, (6) Analyzing data, (7) Concluding. Krulik and Rudnik heuristic approaches are approaches with thinking steps to solve problems that aim to teach specific problem-solving skills that students can use to overcome a particular problem. The term heuristic is used for the definition of looking for something like in a guided discovery activity (discovery learning). In essence, a heuristic is a step to find or solve something, so that mathematics will increasingly develop and be applied to practical problems. Heuristics are steps in solving a problem without having to have sequential boundaries. Heuristics is a general strategy that is not related to the

subject matter, but heuristics are constructive in understanding problems. Through heuristics, it is expected to be able to use maximum skills in solving mathematical problems.

According to Polya in Kusdinar (2016), problem-solving solutions generally contain four steps of completion, namely: (1) Understanding of the problem (SEE), (2) Planning of problem-solving (PLAN), (3) Implementing problem-solving planning (DO) (4) Re-check settlement (CHECK). According to Schoenfeld in Kusdinar (2016), problem-solving is categorized into five categories: Reading, Analysis, Exploration, Planning / Implementation, and Verification. Dewi (2018) categorizes the Krulik and Rudnik Type Heuristic Approach Model consisting of 5 steps, namely: (1) Reading and Thinking, (2) Exploration and Planning (Explore and Plan), (3) Selecting a Strategy (Select Strategy), (4) Look for Answers (Find and Answer), (5) Reflect and Develop (Reflect and Extend).

According to Schoenfeld in Kusdinar (2016), Heuristics will be used here to mean a general suggestion or strategy, independent of any particular topic or subject matter, that helps the problem solver approach and understand a problem efficiently marshal their resources to solve it. Present a road map in solving problems to get the right problem-solving steps and get the right solution. Heuristics become directions that will guide the answers to problems. The formulation of the problem in this research is Whether by applying the guided discovery learning model with the Krulik and Rudnik heuristic approaches can improve the mathematical problem-solving skills of class X students of SMA Negeri 1 Prambanan in the 2018/2019 school year on the Inequality of Two Variables (Linear-Squared).

METHODS

This research uses Classroom Action Research (CAR) through two stages of the cycle. The research will involve mathematics teachers, researchers, and class X MIPA 4 SMA Negeri 1 Prambanan students. This class action research is planned in two cycles. The first cycle is carried out by the plans that have been prepared, while the second cycle aims to complete or improve the first cycle. The first meeting of mathematics learning was given practice questions as a measure of learning success, while for the second meeting, mathematics learning was given a problem-solving skills test. The study was conducted at SMA Negeri 1 Prambanan in the odd semester of the 2018/2019 school year. The research subjects were 32 students of Class X MIPA 4 SMA Negeri 1 Prambanan Academic Year 2018/2019. At the same time, this study's object was the whole process of learning activities using a guided discovery model with a Krulik and Rudnik heuristic approach. Research conducted on mathematics learning.

In this study, the data collection instruments used student observation sheets, interview guidelines, and test questions on students' mathematical problem-solving skills. Instrument validation uses content validation—data analysis techniques using qualitative descriptive methods by looking at trends in the learning process. The data obtained in the form of answers to the test of students' mathematical problem-solving skills, student observation sheets during the process of learning activities carried out, and interviews with students reinforce student observation activities and documentation during learning.

RESULTS AND DISCUSSION

This class action research was carried out in two cycles. Each cycle consists of two meetings, one 2x45-minute meeting. At the second meeting of each cycle, students were given exercises to test math problem-solving skills that could be done in pair discussions with classmates. The researcher acts as a teacher in carrying out mathematics learning activities that apply the guided discovery model with a heuristic approach of the Krulik and Rudnik types. The observers in this classroom action research were three students of UAD mathematics education. The practice test 1 students 'mathematical problem-solving skills in the first cycle show that the average percentage of students' mathematical problem-solving skills is 29.34%. This shows that the mathematics problem-solving skills of students of class X MIPA of SMA Negeri 1 Prambanan in the 2018/2019 school year are still in the low category. This does not meet the success indicators of problem-solving skills that are> 60.

Reflected as a learning plan that will be carried out in cycle II to improve the cycle I design. The results of the practice of test 2 students 'math problem-solving skills in the first cycle show that the average percentage of students' mathematical problem-solving skills is 80.816%. This means that students' mathematical problem-solving skills are in the very high category. This has fulfilled the indicators of the success of problem-solving skills, namely >60. The class action research results consisted of two cycles, namely, cycle I and cycle II. The guided learning model learning activities with the heuristic approach of the Krulik and Rudnik types have shown an increase in mathematics problem-solving skills for students of class X MIPA 4 in SMA Negeri 1 Prambanan in the 2018/2019 school year. This can be seen in Table 2.

Table 2: Improved Results of Students' Mathematical Problem-Solving Skills Results in Cycle I and Cycle II

Indicator	Percentage of Cycle I	Percentage of Cycle II
Understand the Problem	35,417 (low)	100 (very high)
Formulate Problem Resolution (change story problems to mathematical models)	26,389 (low)	73,264 (high)
Carry out Problem Resolution	45,139 (moderate)	77,083 (high)
Write down the conclusions of the solution to the problem	10,417 (very low)	72,917 (high)
Average Percentage	29.34 (low)	80,816 (very high)

Based on the predetermined indicators obtained, each indicator has increased and obtained an average mathematical problem-solving skill of students from 29.34% (low) in the first cycle increased to 80.816% (very high) in the second cycle. This means that students' mathematical problem-solving skills by applying the guided discovery model with a Krulik and Rudnik heuristic approach improve each mathematical problem-solving skills in class X MIPA 4 SMA Negeri 1 Prambanan TA 2018/2019.

Students' mathematical problem-solving skills have improved, this is due to the learning cycle II researchers trying to make the classroom atmosphere with the relationship between teachers and students closer, motivating students so that it raises more significant curiosity in students, and researchers provide the concept of problem-solving stories step by step. The more systematic problem-solving concept helps improve students' mathematical problem-solving skills to understand problems by writing down information that can be known and asked for in a problem. Students are also skilled in developing problem-solving strategies, namely by skilled at making mathematical models of problems. Students can solve these problems by using the necessary abilities possessed systematically and conclude the problem's solution. Students have used the researcher as a source of learning and resource when encountering difficulties in solving problems or understanding the material.

CONCLUSION

The research concludes that applying the guided discovery model with a Krulik and Rudnik heuristic approach in mathematics learning activities can improve students' mathematical problem-solving skills of class X MIPA 4 of SMA Negeri 1 Prambanan in the 2018/2019 school year. This is indicated by the increasing results of the practice questions about problem-solving skills in the first cycle, with an average percentage of 29.34%, which is in the low category increased to 80.816%, including the very high category the second cycle. Besides that, applying the guided discovery model's learning activities with a Krulik and Rudnik heuristic approach encourages students to be more active in mathematics learning activities. This can be seen from the increasing number of students who are active in learning activities.

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