PROFILE OF STORY PROBLEM SOLVING OF THE TANGENT LINE ON THE CIRCLE BY STUDENTS OF CLASS IX E SMPN 5 PALU

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Article Info

ABSTRACT

Completion of story problems by students needs to be profiled so that teachers can know the description or description of students' abilities in solving story problems. This study aims to obtain a profile of the completion of the circle tangent story problem by students of class IX E SMPN 5 Palu. This type of research is descriptive research with a qualitative approach. Data were collected through written tests and interviews. The results of this study showed that SH was able to do the problem correctly as the steps of solving the story problem. Then the results of EZ's solution show that there is an unfinished solution so that the answer obtained is wrong. Then the results of FR's completion showed that he was unable to solve the problem as the steps of solving the story problem so that the answer obtained was incorrect. Based on the results of this study, the researcher draws the conclusion that the profile of solving students' story problems varies based on students' mathematical abilities.

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1. INTRODUCTION

Mathematics is a universal science that underlies the development of modern technology, has an important role in various disciplines and advances human thinking (Permendiknas, 2018). Based on this opinion, mathematics needs to be given to all students starting from elementary school to college which aims to advance human thinking.

One of the learning objectives of mathematics according to (Permendiknas, 2018) is to solve mathematical problems which include the ability to understand problems,

develop mathematical solution models, solve mathematical models, and provide appropriate solutions. Based on these objectives, it can be seen that one of the main focuses of problem solving is the ability to understand problems, develop mathematical solution models, solve mathematical models and provide appropriate solutions.

Solving mathematical models on story problems there are several steps that must be considered, namely understanding the facts which include determining what is known and what is asked, making mathematical models, solving mathematical models, and concluding answers to math story problems. Story problem is a problem in the form of story sentences using everyday language that can be converted into mathematical sentences or mathematical equations (Sari et al., 2017).

(Wulandari, 2015) states that math ability is a person's ability to use their potential and knowledge to solve math problems. Mathematical ability functions in the process of solving math problems, therefore high mathematical ability will affect the success of solving math problems. It cannot be denied that everyone has different abilities from other people.

Based on the results of research (Isnawati, 2017) , found that VIII grade junior high school students have difficulties in the material of the tangent line of the circle including: (1) difficulties in understanding concepts, skills and problem solving abilities (2) difficulties in solving the given circle problems (3) difficulties influenced by other factors. Another example of research (Hamdhani, H., & Haerudin, 2021) on analyzing the mathematical problem solving ability of junior high school students in Class IX on the material of the tangent line of a circle. The results showed that the test results showed that students' mathematical problem solving skills were still low, especially in the indicators of reexamining and planning solutions. In the test results all research subjects did not fulfill the indicators of checking back and planning a solution. On average, they were only able to fulfill the indicators of understanding the problem and implementing the plan, not even all the answers from the research subjects were correct.

One of the interesting materials to be used in this study is the tangent line of the circle. According to (Khairiah, 2018), tangent line is one of the difficult materials in the circle material, in solving it students must be able to understand the concepts and images of the material. The application of tangent lines in everyday life can be seen in the chain on a bicycle or pulley to draw water in a well, the material began to be studied by junior high school students in grade VIII as a prerequisite material for learning mathematics at the high school level.

There have been many studies that examine the completion of the tangent circle story problem, but each previous study has its own characteristics related to the title. Both from what indicators are used, the subjects involved, the stages in the research and so on.

Research conducted by (Setyaningsih, N., 2016) on student difficulties in solving the problem of tangent lines of circles in terms of Polya's method. The results showed that students experienced difficulties especially at the stage of implementing the solution plan and looking back. Meanwhile, student errors lie in interpreting formulas and principle errors in using formulas. In general, the factors that cause difficulties experienced by students are 1) low student comprehension skills, 2) student difficulties in reading the subject matter, 3) weak student memory in using formulas, 4) low student ability to interpret or enter data into formulas, 5) not reviewing or re-examining answers.

This research is relevant to the research that will be conducted by researchers.The relevance lies in the material of the tangent line of the circle. However, the research that will be conducted by researchers is different from previous studies.The difference is that this research was conducted at MTs Muhammadiyah Waru Baki Sukoharjo, while the

researcher will conduct research at SMPN 5 Palu on the profile of solving the story problem of the tangent line of the fellowship of students in class IX E SMPN 5 Palu.

Research conducted by (Feripadli et al., 2021) regarding the analysis of students' difficulties in solving problems on the subject of the tangent line of a circle. The results showed that the difficulties experienced by students in solving problems on the subject of the tangent line of a circle, namely difficulty understanding the meaning of the problem which is classified as low, difficulty understanding the concept which is high, difficulty in the calculation process which is classified as low.

This research is relevant to the research to be conducted by researchers. The relevance lies in the material of the tangent line of the circle. However, the research that will be conducted by researchers is different from previous studies. The difference is that this research was conducted at Al-Islam Benteng Tellue Junior High School, while the prospective researchers will conduct research at SMPN 5 Palu on the profile of solving the story problem of the tangent line of the fellowship of students in class IX E SMPN 5 Palu.

Research conducted by (Dian Elyana, 2023) on student errors in solving the problem of tangent line of a circle. The results obtained showed three types of errors in solving problems on the subject of the tangent line of the circle, namely concept errors, principle errors, and operation errors. These errors are caused by two factors, namely internal factors such as low understanding ability, and external factors such as lack of concentration. Errors that occur and their causes can be given more attention by the teacher to improve mastery of the tangent circle material.

This research is relevant to the research that will be conducted by the researcher. The relevance lies in the material of the tangent line of the circle. However, the research that will be conducted by researchers is different from previous studies. The difference is that this research was conducted at the State Junior High School in Ngargoyoso, while the prospective researchers will conduct research at SMPN 5 Palu on the profile of solving the story problem of the tangent line of the fellowship of students in class IX E SMPN 5 Palu.

esearch conducted by (Kristianingsih, 2019) on the problem solving ability of students solving problems on the tangent line of a circle at SMP Negeri 1 Salatiga. The results showed that the analysis of the results of the subject's work showed that the first subject with the initials SE was only able to go through three stages, namely recognition, definition and formulation, but had not been able to pass the try and evaluate stages. While the second and third subjects with the initials SA and SN were able to go through all stages of John Dewey's problem solving starting from introduction, defining, formulating, trying and evaluating.

This research is relevant to the research that will be conducted by researchers. The relevance lies in the material of the tangent line of the circle. However, the research that will be conducted by researchers is different from previous research. The difference is that this research was conducted at SMPN 1 Salatiga, while the prospective researchers will conduct research at SMPN 5 Palu on the profile of solving the story problem of the tangent line of the fellowship of students in class IX E SMPN 5 Palu.

Based on some of the previous studies above, the novelty of this research is how teachers can find out the profile of solving the story problem of the tangent line of a circle by students based on different mathematical abilities. Because based on the results of interviews with mathematics teachers at SMPN 5 Palu, it was found that teachers did not understand how the profile of students in solving mathematics problems, especially solving the story problem of the tangent line of the circle with various mathematical abilities possessed by students.

Based on the information obtained from the interview with the mathematics teacher at SMPN 5 Palu, it can be used as a reason for researchers to profile the completion of the story problem of the tangent line of the circle with the aim that the teacher can know and understand how the profile of solving the story problem of the tangent line of the circle by students of class IX E SMPN 5 Palu.

Based on this background, the researcher is very interested in conducting research with the title of the profile of solving the story problem of the tangent line of the circle by students of class IX E SMPN 5 Palu.

2. METHOD

This type of research is descriptive with a qualitative approach. Qualitative approach is a research procedure that produces descriptive data in the form of written or spoken words from the subject under study. This research aims to obtain the profile of the completion of the story problem of the tangent line of the circle by students of class IX E SMPN 5 Palu. The subjects of this research were students of class IX E SMPN 5 Palu in the academic year 2023/2024. The number of subjects selected was three students consisting of one student each with high math ability, medium math ability and low math ability. The selection of subjects was carried out by looking at the results of the even semester exam in the 2022/2023 school year.

Students were grouped into three groups, namely high math ability, medium math ability and low math ability. The grouping of student ability levels is based on the grouping put forward by (Arikunto, 2021):

Table 3.1 Categories of Mathematical Ability

Category Grouping	Criteria
$N \geq \bar{x} + SD$	High
$\bar{x} - SD < N < \bar{x} + SD$	Medium
$N \leq \bar{x} - SD$	Low

Description:
N : Student score
$\bar{x}$: Average score
SD : Standard deviation

3. RESULTS AND DISCUSSION

3.1. Results

The selection of subjects in this study was based on the results of the mathematics semester exam in class VIII E SMPN 5 Palu in the 2022/2023 academic year. There were 27 students in class VIII E. Based on the results of the mathematics semester exam, subjects with high mathematics ability, medium mathematics ability and low mathematics ability were grouped. The grouping of students' mathematics ability levels, which is based on the grouping proposed by (Arikunto, 2021), obtained 2 subjects with high mathematics abilities, 17 subjects with moderate mathematics abilities, and 7 subjects with low mathematics abilities. The criteria for grouping subjects are, students who belong to the high math ability category are students who get $N \geq \bar{x} + SD$. Then students who belong to the medium math category are students who get $\bar{x} - SD < N < \bar{x} + SD$, and students who belong to the low math category are students who get $N \leq \bar{x} - SD$. After the research subject was determined, then the subject was given a the written test was in the form of a

description of the story problem of the tangent line of the circle. The test was given to obtain data on students' ability to solve problems. Some time after being given the test, the subject was interviewed by the researcher to obtain deeper information about the subject's answers and understanding of the problems given.

Data exposure is continued with data credibility testing, namely time triangulation. Time triangulation is a technique of testing the credibility of data by checking data with the same subject and equivalent tasks in different times or situations. If the two data produce different data, the task is carried out again until it gets authentic or consistent data (Sugiyono, 2018). The data analysis used in this study refers to qualitative data analysis according to (Miles et al., 2014) which is carried out interactively through the process of data condensation, data presentation (data display) and drawing and verifying conclusions.

Based on the data credibility test, it was found that the subjects with high mathematics ability (SH), moderate mathematics ability (EZ) and low mathematics ability (FR) in solving the problem had shown credible data. Then, to facilitate data analysis of the research that has been done, the researcher uses the transcript code on the written test and   This study uses the steps for solving story problems proposed by (Ismail, 2021), namely the steps for solving math story problems are as follows: 1. Understanding mathematical problems, including: a. Determining what is known in the problem. b. Determining what is asked in the problem, 2. Creating a mathematical model, 3. Solving the mathematical model, 4. Determining the final answer to the problem.

The images of students' written test results contain certain codes. For example, the code SHT1 01, EZT2 02 and FRT1 03. The code "SH" is the code of the high math ability subject, the code "EZ" is the code of the medium math ability subject, the code "FR" is the code of the low math ability subject. After the subject code, there is a T1 or T2 code that indicates the results of stage 1 or stage 2 tests. For example SHT1, EZT2 and FRT1. Then there is the number 1 or which indicates question number 1 or number 2, for example SHT1, EZT2 and FRT1. The numbers 01, 02 and so on, indicate the sequence of student solution steps, for example SHT1 01.

The interview transcripts also contain certain codes. For example, the code SHT1 001 S, EZT2 002 P and FRT1 003 S. There is a code T1 or T2 which indicates the results of the test 1 or test 2 interview, for example SHT1, SHT2, EZT1, EZT2, FRT1 and FRT2. After the interview stage code, there are numbers 1 or 2 indicating question number 1 or number 2, for example SHT1, EZT2 and FRT1. The numbers 001, 002 and so on, indicate the order of the interview, there is a code "P" or "S". code "P" for the researcher and code "S" for the subject, for example SHT1 002 S, EZT2 001 P and FRT1 003 S.

3.1.1   Presentation of Data

a. Presentation of Data on High Mathematics Ability Subjects (SH) in Solving Problem T1

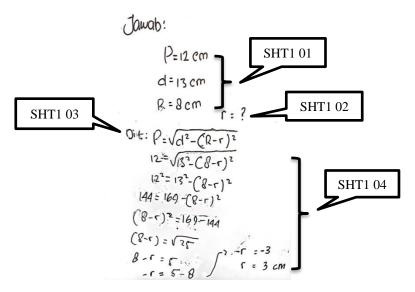SH's written test results in solving the circle tangent story problem:

The condensed interview transcript is presented as follows:
SHT1 009 P : So after that, what did you do to solve the problem?
SHT1 009 S : I write down the formula to find what is asked in the problem, then I substitute the known values in the problem into the formula, then I finish by finding what is asked, namely the length of the radius of the other gear.
SHT1 010 P: Okay. Why did you remove the root sign and square 12?
SHT1 010 S : Because I want to find the value of r, then it becomes 12 squared because when you remove the root on the right side, the left side can be squared.

Figur 1 SH's written test results in solving T1

SHT1 011 P : Then after that, how else?
SHT1 011 S : I wrote down the values of 12^2 and 13^2, then I moved $(8- r)^2$ to the left side.
SHT1 012 P : Why did you move it?
SHT1 012 S : So that I can find the value of the radius.
SHT1 013 P : Okay. After that, how else?
SHT1 013 S : Then I moved 144 to the right rus, then I wrote the subtraction operation so 169 - 144 = 25. Then I omitted the square and added the root so that $(8 - r) = \sqrt{25}$.
SHT1 014 P: Why did you do this?
SHT1 014 S : Because if you do it like that, you can find the value of the radius.
SHT1 015 P : After that, how else?
SHT1 015 S : Then I moved 8 of the right brush so -r = 5- 8
SHT1 016 P : Then is it answered dek?
SHT1 016 S : Not yet, after that I operate the result so - r = -3 then I multiply the two segments by negative so that the result becomes r = 3 cm.
SHT1 017 P : Okay. Are you sure about the answer?Thank you dek.
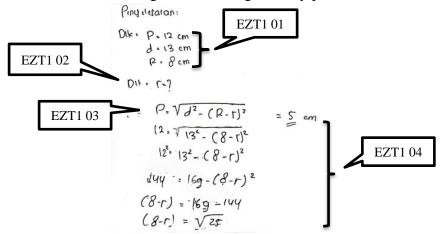SHT1 017 S : Sure.Yes, you're welcome.

Based on the results of the SH subject's answers in Figure 4.1, in SHT1 01 the SH subject wrote what was known in the problem by symbolizing, then wrote what was asked in the problem (SHT1 02). SH started working on the problem by writing down the formula used to solve the problem (SHT1 03), then SH used her math skills correctly to solve the problem so as to obtain the length of the radius.

Based on the interview data in T1 above, it shows that SH started working on the problem by mentioning the formula used to solve the problem. Furthermore, in SHT1 009 S, SH subjects substituted the known values in the problem into the formula, then in SHT1 016 S, SH subjects completed the answer by finding what was asked, namely the length of the radius.

b. Presentation of Data on Moderate Mathematics Ability Subjects (EZ) in Solving Problem T1

EZ's written test results in solving the circle tangent story problem:

Figur 2 EZ's written test results in solving T

The condensed interview transcript is presented as follows:

EZT1 008 P : Okay, after that how else?

EZT1 008 S : Then I substitute the known values in the problem into the formula, then I start operating the numbers.

EZT1 009 P : Then how else?

EZT1 009 S : After that, I remove the root and add the square in the left segment.

EZT1 010 P : Why is that?

EZT1 010 S : I want to eliminate the root, so if the root is missing then I add the square in the opposite segment.

EZT1 011 P : Okay. Then how else?

EZT1 011 S : Then I operate the squared number and I write the subtraction operation between the two numbers, then I move $(8\text{-}r)^2$ to the left segment.

EZT1 012 P : Why did you move it?

EZT1 012 S : To find the value of r.

EZT1 013 P : Okay. After that, how else?

EZT1 013 S : I wrote down the result of the number I subtracted earlier, then I added the root so it's √25.

EZT1 014 P : Then what else do you do?

EZT1 014 S : Then I wrote down the result which is 5 cm.

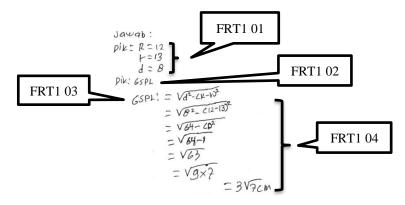EZT1 015 P : Is it answered dek?

EZT1 015 S : Yes, that's all I know.

Based on the results of the EZ subject's answers in Figure 4.2, it shows that in EZT1 01, the SH subject wrote what was known in the problem by symbolizing, then wrote what was asked in the problem (EZT1 02). EZ started working on the problem by writing down the formula used to solve the problem (EZT1 03), then EZ started working on the problem using her mathematical skills, but in solving the problem it was seen that EZ had not completed the answer to the end so that she obtained an incorrect answer.

Based on the data from EZ's interview results in T1 above, it shows that Subject EZ started working on the problem by substituting the known values in the problem into the formula (EZT1 008 S), then at EZT1 014 S subject EZ did not complete the answer, namely finding the length of the radius.

c. Presentation of Data on Low Mathematics Ability Subjects (FR) in Solving Problem T1

FR's written test results in solving the circle tangent story problem:

Figur 3 FR's written test results in solving T1

The condensed interview transcript is presented as follows:
FRT1 009 P : Then how do you want to find the length of the radius of the other gear?
FRT1 009 S : I substitute the known values into the formula.
FRT1 010 P : Then how else?
FRT1 010 S : I operate the value already.
FRT1 011 P : Did you get the final result?
FRT1 011 S : Yes, that's all I know.

Based on the results of the FR subject's answers in Figur 4.3, it shows that in FRT1 01 the FR subject wrote what was known in the problem by symbolizing but was wrong in symbolizing, then wrote what was asked in the problem (FRT1 02). FR started working on the problem by writing down the formula used to solve the problem (FRT1 03), then FR started working on the problem using his mathematical abilities,but in solving the problem it was seen that FR had nit been able to complete the answer correctly.

Based on the FR interview data in T1 above, it shows that in FRT1 009 S the FR subject starts working on the problem by substituting the known values into the formula, then FR starts working on the problem, but in solving the problem it can be seen that FR has not been able to complete the answer correctly so that it does not get the correct answer.

3.2. Discussion

Below will be discussed the research results that have been described previously regarding the profile of solving the story problem of the tangent line of the outer circle. The discussion can be explained as follows:

1. Profile of Story Problem Solving of High Mathematics Ability Students (SH)

Based on the data analysis of the test results and interview results in solving the story problem of the tangent line of the outer circle, SH is able to identify what is known

and what is asked in the problem, this is in line opinion (Ismail, 2021) the steps to solve math story problems are as follows: 1. Understand the math problem, including: a. Determine what is known in the problem. b. Determine what is asked in the problem, 2. Create a mathematical model, 3. Solve the mathematical model, 4. Determine the final answer to the problem. In line with research conducted by (Linola et al., 2017) that the most important thing in solving story problems is knowing the process or steps used to answer the problem. SH is able to explain the understanding that SH knows the tangent line of the outer circle, namely the tangent line of the outer circle is the tangent line that is on the outside of two circles. SH started to solve the problem by rewriting what was known in the problem. Then, SH wrote down the formula used to solve the problem, then SH substituted the known values in the problem into the formula. SH removed the root sign by squaring 12, then SH wrote down the results of 12 and 13 squared. SH moved $(8-r)^2$ to the left segment to find the value of r and wrote the subtraction operation between 169 and 144. SH eliminates the square and adds the root in the right segment, then writes the result which is 5. SH moves 8 to the right segment so -r = 5- 8. After that, SH operates the result so -r = 3 then both segments are multiplied by negative to produce r = 3 cm.

2. Profile of Story Problem Solving of Moderate Mathematics Ability Students (EZ)

Based on the data analysis of test results and interview results in solving the story problem of the tangent line of the outer circle, EZ is able to identify the things known and asked in the problem, this is in line with (Ismail, 2021) the steps to solve math story problems are as follows: 1. Understand the math problem, including: a. Determine what is known in the problem. b. Determine what is asked in the problem, 2. Create a mathematical model, 3. Solve the mathematical model, 4. Determine the final answer to the problem. In line with research conducted by (Linola et al., 2017) that the most important thing in solving story problems is knowing the process or steps used to answer the problem. EZ was able to provide an explanation of the understanding that EZ knew about the tangent line of the outer circle, namely the tangent line of the outer circle is the tangent line that is on the outside of two circles. EZ started solving the problem by rewriting what was known in the problem. Then, EZ wrote down the formula used to solve the problem, then EZ started substituting the known values into the formula. Next, EZ removed the root and added the square to the number symbolized (p), then EZ operated the squared number. EZ moved $(8-r)^2$ to the left segment and added a subtraction operation between the two numbers, then EZ wrote the result of the subtracted number and added the root, but EZ was not precise in solving the problem because there was a step that EZ had not completed but had written the result, which was 5 cm.

3. Profile of Story Problem Solving of Low Mathematics Ability Students (FR)

Based on the data analysis of the test results and interview results in solving the story problem of the tangent line of the outer circle, FR was unable to identify the things known and asked in the problem, this is not in line with opinion (Ismail, 2021) the steps to solve math story problems are as follows: 1. Understand the math problem, including: a. Determine what is known in the problem. b. Determine what is asked in the problem, 2. Create a mathematical model, 3. Solve the mathematical model, 4. Determine the final answer to the problem. In line with research conducted by (Linola et al., 2017) that the most important thing in solving story problems is knowing the process or steps used to answer the problem. FR wrote down the formula used to solve the problem, then FR began to substitute the known numbers into the formula, but because FR was wrong in

symbolizing so that after the substitution did not find the desired result, the next step that FR did was wrong, then FR operated the numbers in the root to find the final result, then FR wrote the final result 3√7 cm. In this case, FR was wrong in solving the problem.

4. CONCLUSION

The completion of high mathematics ability students in solving the story problem of the tangent of the outer circle begins with writing the known and the questionable things in the problem then writing the formula to be used in solving and solving the problem correctly.

The solution of students with moderate mathematics ability in solving the story problem of the tangent line of the outer circle begins with writing the known things and the things asked in the problem then writing the formula to be used in the solution but the completion step has not reached the final solution so that the answer is unfinished and gets the wrong result.

The completion of low mathematics ability students in solving the story problem of the tangent line of the outer circle begins with writing down the known and the questionable things in the problem but mistakenly writing them down then writing down the formula to be used in the solution but at the completion step there are errors in solving the problem so that the completion steps done are not appropriate and obtain incorrect results.

Based on the discussion and conclusions obtained, the suggestions that need to be conveyed by the researcher are: In giving problems to students, teachers should familiarize students to work on problems according to the complete solution steps, and often provide problem exercises to students so that students do not have difficulty solving the problems given.

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