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ANALYSIS OF PROBLEM-SOLVING ABILITY BASED ON STUDENT GENDER

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Abstract

Problem-solving skills are important for students to be able to overcome problems in mathematics and everyday life. However, 12th grade students at SMK Negeri 2 Kotabumi still lack adequate problem-solving skills. This study aims to explain how male and female students solve problems in statistics with the topic of single data mean at SMK Negeri 2 Kotabumi. This study employs a descriptive qualitative method. The research subjects consist of two male students and two female students in the 12th grade of the Computer Networking Technology program, selected using purposive sampling. The research instruments include the researcher themselves, a test instrument, and an interview guide. Data collection methods included tests and interviews. To verify data validity, triangulation of time, research persistence, and member checks were used. Data analysis methods included data reduction, data presentation, and conclusion drawing. The results of this study indicate that male students successfully completed each stage of problem-solving according to Polya. The process begins with understanding the problem, formulating a solution plan, implementing the plan, and finally checking the answer. Female students successfully carried out three of the four problem-solving stages according to Polya, namely understanding the problem, designing a solution, and implementing the plan. However, in the stage of checking the answer, female students often skipped this step.

Keywords: ***Gender, Problem Solving Ability, Statistics***

1. INTRODUCTION

In Indonesia, mathematics is a compulsory subject taught at all levels of education, from elementary school to high school [1]. This is because mathematics is considered the main foundation of science and is needed by other sciences [2]. Mathematics plays an important role in education because it can help students develop problem-solving skills

while learning mathematics [3]. Problem-solving skills (PSS) are one of the skills that can be improved while studying mathematics [4].

In learning mathematics, PSS is one of the targets that students must achieve according to the Ministry of National Education Regulation No. 22 of 2006 [5]. Thus, the ability to solve problems is an important skill for students to possess and master [6]. This is emphasized by [7], who highlights the importance of PSK as the core of mathematics learning, making it a fundamental skill that students must possess. According to [8], KPM refers to the capacity or potential of students to apply knowledge they have understood to new contextual situations related to everyday problems. In line with the opinion of [9], KPM is an individual effort to utilize existing knowledge, understanding, and insights to find solutions to encountered problems. In solving problems, Polya states there are four stages to observe and measure students' KPM, including: (1) identifying the problem, (2) developing a problem-solving plan, (3) implementing the plan, and (4) verifying the solution [10]. To measure students' KPM, one of the materials in mathematics lessons that can be used is statistics.

Statistics is a subject that includes problem-solving-based questions, so solving statistical problems can reveal students' problem-solving skills [11]. Statistics has various problems that can be used to assess students' problem-solving skills. Additionally, statistics is important to study because it is useful in everyday life. One important topic in this subject is the mean. The discussion of the mean in statistics plays a crucial role because it is a statistical analysis frequently used among other measures of central tendency. In daily life, the mean is commonly used to analyze various things, such as calculating the average test scores, income, or even daily temperatures.

In fact, students do not yet have good KPM. This is evidenced by a preliminary study conducted at SMK Negeri 2 Kotabumi. During the preliminary study using the KPM test, 19 students took the test. Based on the results of the answers, it shows that students have not been successful in solving the problems given properly and correctly. Out of

the 19 students who took the test, only 3 answered the questions correctly, 11 students were only able to meet some of the indicators, and the remaining 5 students did not answer the questions due to confusion over how to solve them. Therefore, based on the data from the preliminary research, it can be concluded that the KPM in statistics among students at SMK Negeri 2 Kotabumi is still considered poor.

In the field of education, the KPM of male students (Siswa) and female students (Siswi) is a matter of concern [12]. This is because KPM can vary, one of which is influenced by gender differences [13]. Male and female students demonstrate different methods in solving problem-based questions [14]. Generally, male students tend to excel in reasoning, while female students are more prominent in precision and accuracy when solving problems [15]. Gender refers to the differences that distinguish individuals as male or female students, typically observed through physical and biological characteristics such as reproductive organs. Gender is one form of identity that distinguishes individuals as male or female students [16]. Gender differences cause differences in emotions, habits, mindsets, and problem-solving abilities.

Relevant research such as that conducted by [17] on KPM analysis based on Polya's steps and research by [14] on KPM analysis of students on pyramid material reviewed based on gender, based on this relevant research, there has been no further study related to KPM students on the main topic of single data reviewed based on gender. Additionally, research on KPM based on gender indicates that female students' KPM is better than male students' [18] and [19]. Furthermore, similar research by [20] and [21] found that male students' KPM is superior to female students'. Based on the above, it is worthwhile to conduct an analysis of KPM among students based on gender with the aim of describing KPM among male and female students in the main topic of single data mean at SMK Negeri 2 Kotabumi.

2. RESEARCH METHOD

The purpose of this study is to describe the KPM of male and female students on the subject of single data mean at SMK Negeri 2 Kotabumi. The research method used is qualitative descriptive in the form of a case study. Four students were selected as informants for this study, consisting of two male students and two female students from XII TKJ 1 (Computer Networking Technology) at SMK Negeri 2 Kotabumi for the 2024/2025 academic year. The selection of informants was based on purposive sampling. Purposive sampling is a technique for determining data sources by considering specific characteristics. The characteristics considered include (1) informants attending SMK Negeri 2 Kotabumi, (2) having studied statistics with a focus on single data mean, (3) informants being able to communicate well, (4) informants being willing to be interviewed, and (5) consisting of male and female students. The data collection tools (instruments) include the researcher as the primary instrument and supporting instruments consisting of a test instrument with 3 questions and a semi-structured interview guide. The methods used to collect data in the field are tests and interviews. The data obtained in the field must then be validated to ensure its validity. The validity tests used include time triangulation, research persistence, and member checking. Once the data is validated, it is analyzed using data reduction techniques, data presentation, and conclusion drawing.

3. RESULTS AND DISCUSSION

Results

Analysis of male students' KPM based on Polya's stages

1) Understanding the Problem (KPM1)

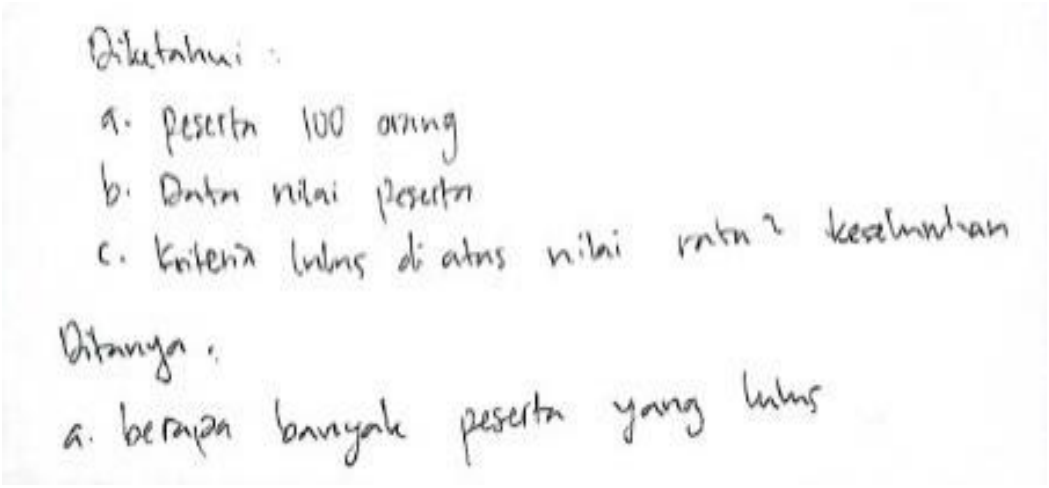


Figure 1 SL Answers

Figure 1 above shows that SL records the information or components known and the problems or questions asked in the question in detail and correctly. Then SL explains it verbally, which is confirmed based on the data from the interview with SL.

2) Creating a Problem Solving Plan (KPM2)

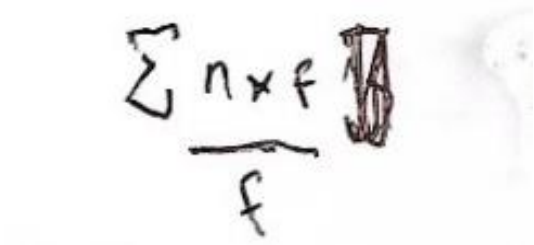


Figure 2 SL Answers

Figure 2 above shows that SL wrote down a problem-solving plan using the average formula but did not write the formula symbol correctly. This was because SL did not know the correct symbol, as confirmed through an interview, and SL also explained well the plan made to solve the problem.

3) Implementing the Problem Solving Plan (KPM3)

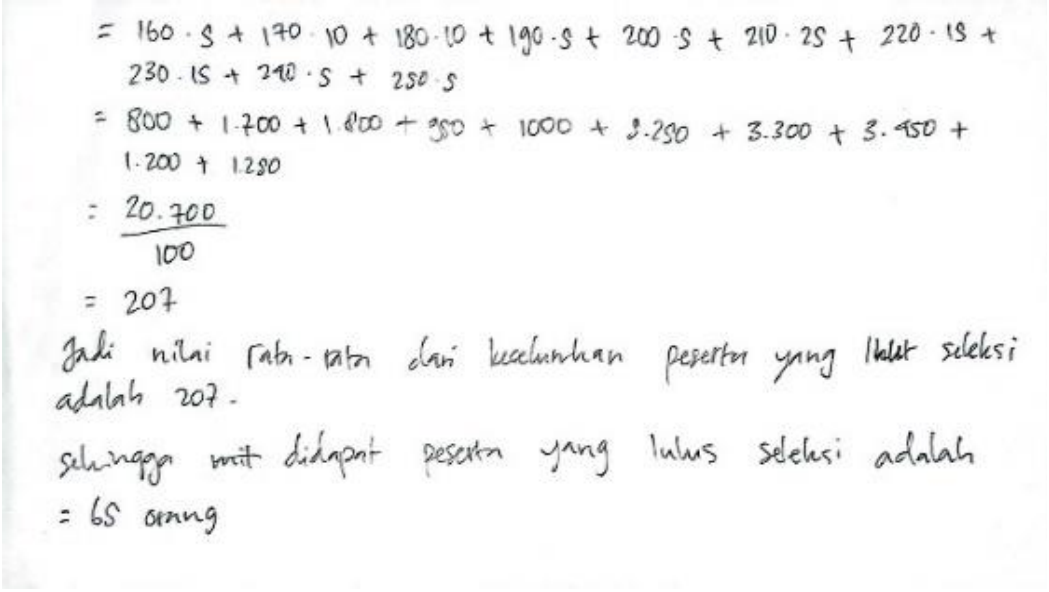


Figure 3 SL Answers

Based on Figure 3, it can be seen that SL implemented or executed the previously made design accurately and performed calculations carefully. In addition, based on the interview results, SL explained well the overall implementation of the plan, namely by finding the average value of the participants' scores to determine how many participants passed the selection.

4) Reviewing (Checking) Answers (KPM4)

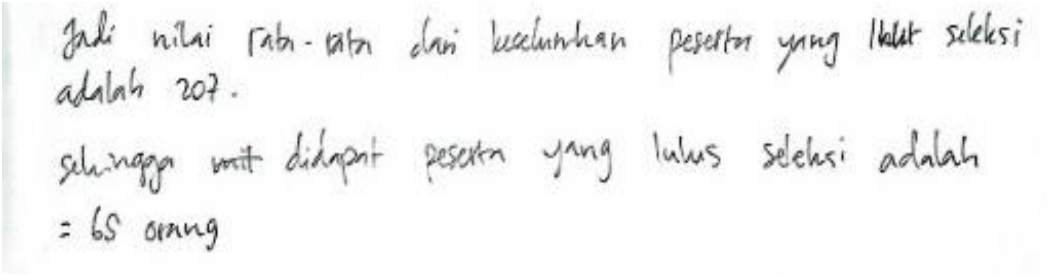


Figure 4 SL Answers

Figure 4 above shows that SL made and wrote down the final conclusions of all the stages carried out. Based on the interview results,

it was confirmed that SL double-checked the answers by recalculating and rereading the answers written on the answer sheet to ensure that there were no errors.

Analysis of female students' KPM (SP) based on Polya's stages

1) Understanding the Problem (KPM1)

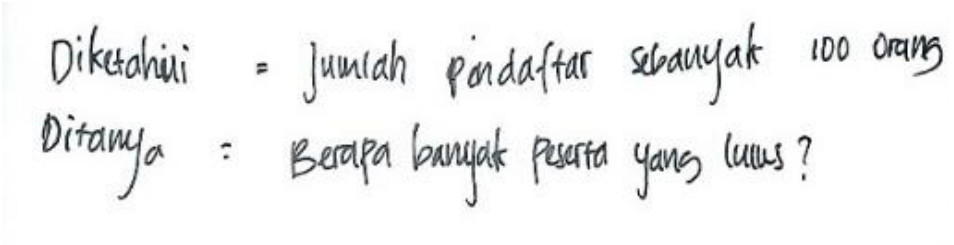


Figure 5 SP Answers

Based on Figure 5, it can be seen that SP wrote down the information or components that were known as well as the problems or questions in the questions in detail and correctly. Then SP also presented verbally what was confirmed based on the interview data.

2) Creating a Problem Solving Plan (KPM2)

Based on the data obtained, SP did not write down the strategy for solving the problem on the answer sheet. This reason was confirmed based on the results of an interview with SP, namely because he did not know how to write the correct formula symbols. However, during the interview, SP was able to explain the plan he had made to solve the problem clearly and correctly.

3) Implementing the Problem Solving Plan (KPM3)

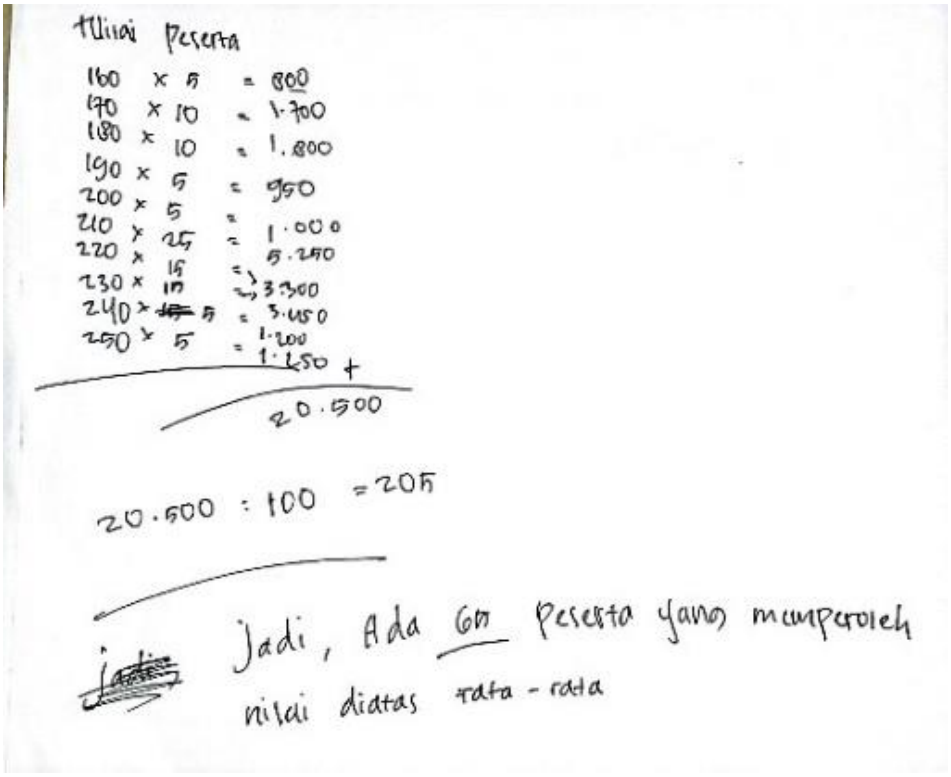


Figure 6 SP Answers

SP implemented the previously developed solution plan but encountered a slight error in calculating the average value, as shown in Figure 6, which indicates that the average result obtained was inaccurate. Based on the interview, SP explained the implementation that had been carried out well, but encountered a calculation error due to a lack of thoroughness.

4) Reviewing (Checking) Answers (KPM4)

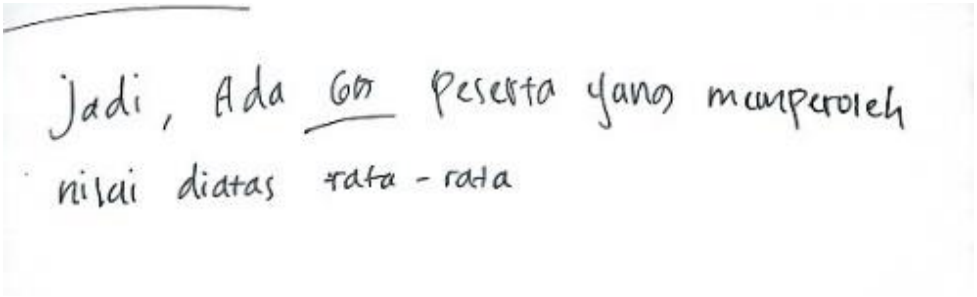


Figure 7 SP Answers

Based on Figure 7, SP made and recorded conclusions on the answer sheet. However, based on interviews, it was confirmed that SP did not double-check the answers because it had become a habit and assumed that once the answers were obtained, the problem was solved and the answers were considered correct.

Discussion

Analysis of male students' KPM based on Polya's problem-solving stages

In the first stage, SL in KPM1 is carried out by determining the known information or components and identifying the problems or questions contained in the question without having to read it repeatedly or just reading the question once and immediately understanding the question given. SL also presents this information and these problems both in written form on the answer sheet and orally through interviews. In line with Jati's opinion [22], in understanding problems, students use logic and read the question once to find the known and unknown components in the question.

Furthermore, in KPM2, SL develops or determines a plan that can be applied to solve the existing problems. The problem-solving plan created by SL involves using the average or mean formula to find solutions to the three given questions. SL also explained the problem-solving plan well verbally, but when presenting the problem-solving plan in writing, SL often made mistakes in writing the correct average formula symbol. In line with the research [23], students made problem-solving plans even though they made mistakes when writing the formula.

In the third stage, KPM3, SL implemented the problem-solving plan that had been made previously so that he could find the answers to the problems in the questions. SL performed calculations to find the

average value by adding up the scores of the participants and dividing them by the number of participants to find out how many participants passed the selection. However, SL sometimes did not write down the implementation of the plan completely or wrote down the results directly. In line with research [24], students can execute a pre-determined problem-solving plan even if they do not fully document the process or directly write down the results of their work.

In the fourth stage, KPM4, SL double-checked their answers by reviewing and re-reading the text on the answer sheet and performing calculations again to ensure there were no errors. SL also formulated and wrote conclusions regarding the resolution of the problem. This aligns with research [25] indicating that students in the review stage draw conclusions from the problem-solving process they have completed.

From the description of SL's KPM above, it can be concluded that SL successfully carried out each stage of problem-solving according to Polya. This is supported by the results of research [26] that male subjects are able to solve problems by following all stages of Polya in solving existing problems.

Analysis of female students' KPM (SP) based on Polya's problem-solving stages

In the KPM1 stage, SP identifies, explains, and records the information obtained and what is problematic or questionable in the question. However, SP takes a little longer to understand the problem because they have to read the question repeatedly first, and the information SP writes on the answer sheet is often incomplete or not detailed enough. In line with the research [27], when understanding the problem, the student identifies all the information or components that are known and what the question is in the problem, and writes them down on the answer sheet.

At the KPM2 stage, SP develops a strategy to be used in the next stage by using the confirmed single data average formula during the

interview. However, for presenting the problem-solving plan in written form, SP did not write it on the answer sheet because they did not know the correct way to write the formula symbols, so they felt it was better not to write it than to make a mistake in writing the plan. In line with research [28], students can develop strategies to be used for solving problems.

At the KPM3 stage, SP implemented the solution plan that had been created earlier, although there were some errors during the calculation of the average value. This was evident from the written answers on the answer sheet, where SP incorrectly wrote the average value obtained, and based on the interview results, SP was not careful during the calculation. This is in line with research [25] which states that female students carry out the procedures of the plan they have made even though they make mistakes.

At the KPM4 stage, SP drew conclusions from the work that had been done, but neglected to recheck the answers written on the answer sheet. This was confirmed during the interview, where SP stated that they felt it was unnecessary to recheck the answers because once they had obtained the results or answers and felt that they had found the answers, that meant they had solved the problem. In line with the findings of [29], students do not review their answers after completing the task, resulting in the review stage not being fulfilled.

Based on the above discussion of SP's KPM, it is concluded that SP only completed three of the four steps of Polya's problem-solving process, which consist of understanding the problem, designing a solution strategy, and implementing the plan. This is supported by research [24] that female students often do not recheck the answers they have obtained.

New Research Findings

This study found that female students only carried out 3 of the 4 stages of problem solving according to Polya, namely understanding the problem, making a plan to solve the problem, implementing the

plan to solve the problem, and in the final stage, which was always ignored by female students, namely checking the answer again. This differs from the findings of studies conducted by [25] and [27], which stated that female students were able to perform all stages of problem-solving according to Polya effectively, from understanding the problem to rechecking the answers by performing recalculations.

4. CONCLUSION AND RECOMMENDATIONS

Students in understanding problems include quickly identifying known components and questions in the problem and writing them in detail on the answer sheet; making a problem-solving plan, male students make a plan that will be used to solve the problem, namely by using the single data mean formula; implementing the problem-solving plan, male students implement or execute the previously developed plan effectively, with accurate calculations, resulting in correct outcomes; reviewing (checking) the answers, male students draw conclusions from the work done and perform recalculations on the obtained results to ensure no errors have occurred.

When understanding the problem, female students identified the known and unknown components and wrote them down on the answer sheet, even though it took a little longer because they had to read the question repeatedly. In developing a problem-solving strategy, female students determined the strategy to be implemented in solving the problem, which was to use the single data mean formula. implementing the problem-solving plan, female students apply the previously devised plan and perform calculations, even though they occasionally make minor errors; reviewing (checking) the answers, female students draw conclusions from the work they have done, but often skip the step of reviewing the answers because they feel that if they have obtained the answer, then the answer is already correct.

In the research that has been conducted, there are several limitations encountered, including the following.

a. Only able to analyze KPM based on gender with 4 subjects, namely 2 male students and 2 female students, and the analysis only focused on the subject of single data mean.
b. The subjects made errors in implementing the problem-solving plan, but this study could only analyze the subjects' KPM, so it was unable to conduct a thorough analysis of the errors made by the subjects in solving the main topic of single data mean.
c. The subjects often made mistakes in writing the problem-solving plan they created, but when asked to explain, the subjects were able to explain the plan. However, this study only focused on the subjects' KPM, so it was not possible to conduct an in-depth analysis of the subjects' communication skills in solving the main topic of single mean data.

Based on the limitations of this study, it is recommended that future researchers: (1) use the results of this study as a reference for those who wish to conduct research with different subjects, locations, and materials, (2) further examine students' errors in solving problems related to the topic of single data mean, and (3) examine students' communication skills in solving problems related to the topic of single data mean.

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