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Analysis Of Student Difficulties in Solving Problems on Statistics Material

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Abstract
This study aimed to describe the types of mathematics learning difficulties experienced by students in solving statistical problems related to mean, median, and mode. The research employed a qualitative descriptive approach with three eighth-grade students as subjects, selected based on high, medium, and low ability levels. Data were collected through written tests and structured interviews.The findings revealed that the three students faced different types of learning difficulties, categorized into four main aspects: difficulty understanding concepts, difficulty in mathematical modeling, difficulty in performing calculations, and difficulty in drawing conclusions. Students with low ability tended to experience all four types of difficulties simultaneously, while those with medium and high abilities demonstrated weaknesses in one or two aspects only.These results highlight the crucial role of teachers in providing continuous guidance and scaffolding to help students strengthen their conceptual understanding and develop step-by-step mathematical reasoning skills, particularly in solving statistical problems effectively. Distinct from general error analysis, this study specifically identifies the failure in mathematical modeling as the critical bottleneck for students, distinguishing between procedural slips in high-ability students and conceptual deficits in low-ability students.

Keywords: *Learning Difficulties; Mathematics Education; Statistics; Conceptual Understanding; Problem Solving*

1. Introduction

Mathematics is the queen of sciences, which means that mathematics is the source of other knowledge. Mathematics plays a very important role because it is a basic science that is widely used in various fields of life. Through learning mathematics, students are expected to develop critical thinking and creativity (Hariana, 2015).

Statistics is a branch of mathematics that plays an important role in various fields of science, such as economics and social sciences. At the secondary education level, its application is not only to meet curriculum requirements but also to help students hone their logical and analytical thinking skills, which are very much needed in today's modern era.

Mathematics and statistics are closely related. Mathematics is often used as a theoretical basis for developing methods and techniques in statistics. Statistics itself is considered a part of applied mathematics because it utilizes various mathematical concepts and tools to analyze data and draw conclusions. In education, basic

mathematical skills such as algebra, calculus, and probability have a significant impact on the success of students in learning statistics.

Statistics is a branch of science closely related to mathematics, especially through the application of probability theory as the basis for data processing and analysis. Probability theory, which is part of mathematics, is used to measure uncertainty and assist in decision-making based on available data.

In the context of statistical inference, probability distributions such as normal and binomial distributions are often used to model random variables and estimate population parameters from samples. Therefore, statistics cannot be separated from mathematical concepts, especially probability, which is the basis for various statistical procedures such as hypothesis testing and parameter estimation (Sari and Wulandari, 2019).

Although statistics and mathematics are closely related, they are not entirely identical. Mathematics is deductive, moving from general principles to specific applications and tending to emphasize logical accuracy and proof. On the other hand, statistics is inductive, drawing generalizations from available data. Statistics uses an approach based on data and uncertainty, which does not always demand a single definitive answer, but rather interpretation based on evidence.

A study conducted by Andriani (2017) shows that there is a positive relationship between basic mathematical ability and statistical learning outcomes. This study used multiple linear regression to analyze data from students in the D3 Business Management study program. The results of the analysis show that there is a positive relationship of 23% between basic mathematical skills (which include algebra, calculus, and probability) and students' learning outcomes in statistics. This shows that the better the students' basic mathematical skills, the higher their learning outcomes in statistics courses.

In addition, another study conducted by Mutmainah (2020) at STAIN Manado also found that there is a significant relationship between initial mathematical ability and basic statistics learning outcomes. Using regression and multiple correlation analysis, this study revealed that the contribution of prior mathematical ability to statistics learning outcomes reached 82.81%. This confirms that students with better prior mathematical ability tend to have better learning outcomes in statistics.

Another study by Ihwal, M., and Indrawati, W. O. (2023) also supports this finding by showing that 32.95% of the variation in statistics learning outcomes can be explained by students' basic mathematical abilities. This study emphasizes the importance of strengthening basic mathematical abilities to improve statistics learning outcomes among students.

Overall, the relationship between mathematics and statistics is very important, especially in education. Basic mathematical skills are not only a prerequisite for understanding statistical concepts but also have a major impact on students' academic success in this field. Therefore, it is very important for schools or universities to focus more on strengthening students' basic mathematical skills. That way, they can learn statistics better and achieve optimal results.

According to the Minister of Education and Culture Regulation (Permendikbud) No. 37 of 2018, competency in statistics is an integral part of the mathematics curriculum because of its relevance in data-based decision-making. Statistics also plays a strategic role in supporting data literacy in the digital age. Ridgway (2016) states that statistical literacy is one of the main competencies that individuals must have to actively participate in a data-based society.

Despite the importance of this material, many students have difficulty understanding basic statistical concepts. Research by Dewi et al. (2020) shows that around 83% of students make mistakes in determining average values and 80% have difficulty analyzing statistical data. This shows that there is a gap between the expected learning objectives and the actual abilities of students.

Based on a report from the OECD (2019), the mathematical abilities of Indonesian students are still below the average of OECD member countries, especially in terms of data analysis and statistical understanding. This indicates that there are major challenges in statistics learning that need to be

overcome so that students can master the competencies needed to face global challenges.

Students' difficulties in solving statistical problems can have a significant impact on their academic achievement. Based on the results of the analysis, most students have difficulty creating visual representations because they are unable to connect mathematical concepts or ideas into appropriate images or diagrams. This difficulty causes students to tend to make mistakes in solving problems that require visual representation (Anggraini & Rahman, 2022).

Furthermore, students' difficulties in solving statistics problems often cover several important aspects. Research by Mediyani and Mahtum (2020) shows that around 70% of students make mistakes in determining the mean and median values of data. In addition, students also often have difficulty analyzing data and drawing conclusions from the information provided.

The factors causing difficulties in solving problems in statistics vary, ranging from a lack of understanding of basic statistical concepts to an inability to apply the correct formulas. Research by Febriyanti and Chotimah (2016) confirms that students often experience confusion when faced with word problems that require contextual understanding and direct application of concepts.

Furthermore, research by Dwidarti et al. (2021) shows that students experience difficulties not only in academic terms but also in mathematical communication. Many students are unable to explain the steps to solve problems verbally, which indicates problems in deeper conceptual understanding.

Although there have been several studies discussing difficulties in learning mathematics in general, there are still few studies that specifically look at students' difficulties in statistics at the junior high school level. Most previous studies have focused more on higher education or only highlighted certain aspects of mathematics learning without exploring specific difficulties in statistics.

Research by As'ari et al. (2017) shows that many students do not receive sufficient support to understand how to apply statistical concepts in practice. As a result, they feel that this material is too abstract and difficult to understand. Therefore, it is very important to conduct a more in-depth analysis of the various difficulties faced by junior high school students when working on statistics problems and the factors that cause them.

The urgency of this research is very important because literacy and numeracy are key skills in the 21st century. By understanding the difficulties faced by students in-depth through this research, it is hoped that teachers can design learning methods that are more suited to the needs of students. This aims to improve students' understanding and learning achievement in statistics. In facing the challenges of mathematics learning, especially in statistics, it is important to understand and evaluate the difficulties experienced by students. This study aims to identify the factors that cause these difficulties and offer relevant solutions so that students at a generic junior high school in Indonesia can more easily understand statistics material well.

Through an in-depth qualitative approach that takes the local context into account, it is hoped that the results of this study can make a meaningful contribution to the development of more effective learning strategies in schools. In addition, this study also aims to add to the literature on mathematics education and provide new insights for educators and policymakers in their efforts to improve the overall quality of mathematics education.

Understanding the difficulties students face in learning statistics is an important first step in creating a more supportive learning environment. This will help prepare students to play an active role in a society that will increasingly rely on data in the future.

Students' difficulties in understanding statistics are a major challenge for the world of education that requires serious attention from various parties, including teachers, educational researchers, and policymakers. Through this study, it is hoped that concrete solutions can be found to help students at the researched school better understand statistics and develop the analytical skills needed in the digital age. Thus, Indonesia's young generation will be better prepared to face global challenges with

strong critical thinking and data-based skills. This research is not only relevant to the academic world but also has practical implications in creating a more supportive learning environment for the development of students' mathematical competencies in Indonesia.

This research focuses on analyzing the difficulties experienced by students of a secondary school in Indonesia in solving statistics problems. The students of an Islamic Junior High School in Indonesia were chosen as the research subjects because they directly face challenges in understanding and applying statistical concepts. The relationship between the research and the object of study is very close, where the main objective of this study is to identify the various types of difficulties experienced by students and analyze the factors that cause them. Using an in-depth qualitative approach, this study aims to explore students' experiences and understand the contexts that influence their learning difficulties.

This study seeks to address the gap between students' current abilities and expected learning objectives, so that it can provide concrete recommendations for teachers to improve the effectiveness of statistics teaching. In this way, this study not only has academic relevance but also a practical impact in creating a more supportive learning environment for students. Based on the explanation above, the researcher is interested in conducting a study entitled “An Analysis of the Difficulties of Junior High School Students Students in Solving Problems in Statistics.”

2. Literature Review

2.1. Difficulty Analysis

Analysis is a thinking activity that involves breaking down a whole into its constituent components to understand their characteristics, interrelationships, and individual functions within the integrated system (Komaruddin, 2001). Similarly, Bungin (2008) defines analysis as the process of deconstructing complex problems into smaller parts to gain a deeper understanding of a subject. In a related context, difficulty refers to a situation where an individual encounters obstacles. Mulyadi (2010) specifies that in learning, a difficulty is a condition marked by impediments to achieving goals, thus requiring greater effort to overcome.

2.2. Difficulties in Solving Statistics Problems

Statistical problems fundamentally involve the comprehensive process of collecting, processing, analyzing, and interpreting data to make informed decisions or predictions about a phenomenon (Cox, 1950). A primary goal of this process is to measure uncertainty and generate reliable population estimates from sample data (Gosset, 1908). Cox (1950) also highlights the critical role of these problems in experimental research, where they are essential for evaluating results and validating hypotheses.

However, students often encounter significant **difficulties** when solving these problems. These challenges typically stem from a weak grasp of concepts, poor calculation skills, or an inability to formulate a problem-solving strategy. This is supported by research from Rukhmana (2019), which found that students struggle with both fundamental statistical concepts and the planning of solution steps.

These difficulties can be broken down into three main categories:

- Conceptual Difficulties: An inability to understand and apply the theories that form the basis of statistical problems.
- Skill-based Difficulties: A lack of proficiency in performing necessary calculations and data analysis, often resulting in careless errors during the process.
- Principle-based Difficulties: A weak foundational understanding of the core principles that govern statistics.

2.3. Factors Contributing to Difficulties in Learning Statistics

Student difficulties in understanding statistics can be attributed to both external and internal factors.

External factors, such as teaching methods and the learning environment, play a significant role.

- Teaching Methods: Instructional approaches that are not interactive or suited to diverse learning styles can be a primary obstacle.

Methods relying heavily on lectures, without active student involvement, often result in a monotonous and unengaging learning process. Therefore, employing innovative and varied teaching strategies that are tailored to student characteristics is essential for improving comprehension (Suherman, 2001).

- Learning Environment: The physical environment also has a considerable influence. A non-conducive setting—such as a noisy classroom or poor lighting—can impede concentration. Conversely, a comfortable, organized, and supportive atmosphere that encourages active participation can enhance student motivation and improve learning outcomes (Wena, 2011).

Internal factors specific to the student, including their personal motivation and foundational skills, are equally critical.

- Interest and Motivation: A student's interest and motivation directly impact their level of understanding. Those with low interest tend to be passive, exert minimal effort, and lose focus quickly. In contrast, highly motivated students are typically more diligent, ask questions, and persevere through challenges. This aligns with research indicating that high motivation positively contributes to a student's ability to grasp statistical concepts (Kartikasari & Isnuranni, 2023).

- Basic Mathematical Abilities: Foundational mathematical ability is a key prerequisite for success in statistics. Many students struggle because of a weak mastery of fundamental concepts, such as algebraic and arithmetic operations. This limitation creates a significant barrier, making it difficult for them to perform necessary calculations and analyze the relationships between data (Dewi et al., 2020).

3. Method

3.1. Research Design

This study employed a descriptive qualitative research design. The primary aim was to describe and understand the phenomenon of students' difficulties in solving statistics problems without relying on numerical calculations. This approach was chosen to gain an in-depth understanding of the situation students experience, with data collected directly through methods like observation and interviews (Sonny Leksono, 2013).

3.2. Setting and Timeline

The research was conducted at Junior High School in Indonesia. The study was implemented from 2025. The sole variable in this study was the students' difficulty in solving statistics problems, defined as an object of study describing a specific condition or value (Tritjahjo, 2019).

3.3. Participants and Data Sources

The primary data sources for this study were the students of the selected school. From the pool of students, three research subjects were purposively selected based on their performance on a written test. The subjects were categorized based on their test results into three distinct ability levels: Subject A represented the **Low Ability** group (experiencing High Difficulty), Subject B represented the **Medium Ability** group, and Subject C represented the **High Ability** group (experiencing Low Difficulty). This classification allows for a comparative analysis of how difficulties manifest differently across ability levels. This method of categorization and coding is consistent with established research practices (Sari & Prasetyo, 2002).

3.4. Research Instruments

Two primary instruments were used to collect data:

- Written Test: A test consisting of three syllabus-based questions was used to measure students' ability to solve statistics problems (Suharsimi Arikunto, 2019). The instrument was validated by experts, and students were given 90 minutes for completion.

- Interview Guidelines: Semi-structured interviews were conducted to explore in-depth information about the specific

difficulties students experienced while solving the problems (Burhan Bungin, 2013).

3.5. Data Collection and Analysis Procedures

The data collection process involved two stages: first administering the written test to identify errors and initial difficulties, followed by interviews to clarify the reasons behind those errors.

The data was then analyzed using a qualitative approach, following the stages outlined by Moleong (2018):

1. Data Collection
2. Data Reduction (selecting and simplifying data)
3. Data Categorization
4. Data Presentation
5. Conclusion Drawing

3.6. Data Validity

To ensure the credibility of the findings, this study employed two data validity techniques:

- Increased Persistence: This involved careful, detailed, and repeated observation and re-examination of the students' written work to ensure a thorough understanding.
- Technique Triangulation: The results from the written tests were cross-referenced with the data from the interviews. This process ensured the consistency and accuracy of the findings by comparing data from two different sources.

By following these steps, the study is expected to produce valid findings that describe in depth the difficulties students face in understanding statistics.

4. Results and Discussion

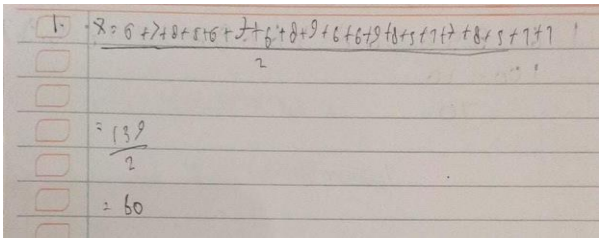
A test administered to 30 students in class VIII-8 at the school provided an overview of their difficulty level in solving statistics problems. The test, which consisted of three questions, measured the students' ability to determine the mean, median, and mode of a data set. Based on the results, students were classified into three categories of difficulty: **high, medium, and low**.

The results showed that 9 students fell into the **high difficulty** category, scoring below 18. These students faced significant challenges, which included a lack of understanding of basic concepts (such as determining the mean or median), confusion in selecting the correct formulas, and repeated calculation errors. Furthermore, some were unable to draw proper conclusions from their results or failed to complete the questions entirely. This indicates that students in this category require targeted instructional support, such as remedial learning or intensive assistance, to better understand the material.

Additionally, 7 students were placed in the **medium difficulty** category. This group demonstrated a partial understanding of the material but was prone to specific mistakes, including calculation errors, incorrect formula application, and logical flaws in their conclusions. While generally able to understand the questions, they showed hesitation or made errors during the problem-solving process. This suggests a need for teachers to reinforce core concepts and provide additional practice to improve the students' accuracy and understanding.

Finally, the largest group, consisting of 13 students, was in the **low difficulty** category, indicating strong performance. These students generally had a good command of basic statistical concepts, capably understanding the questions, identifying necessary data, selecting the right formulas, and performing calculations correctly. Although minor errors were possible, their overall abilities were proficient, reflecting the effectiveness of the instruction they had received.

To gain deeper insight and triangulate the data, the researcher selected three students for interviews, one from each difficulty category (high, medium, and low). These subjects were chosen based on their written test answers, mathematical abilities, and their potential to be representative of their respective performance groups.



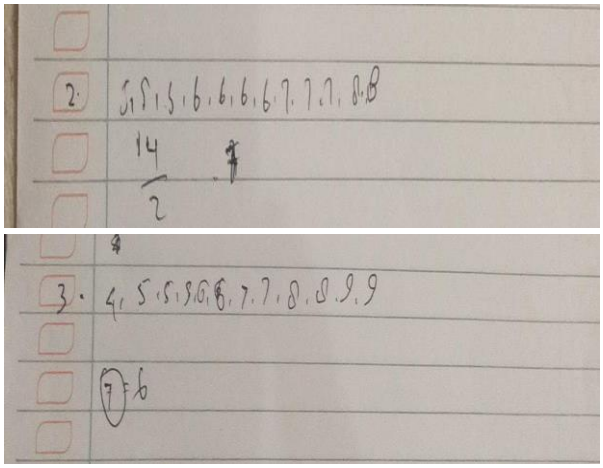


Figure 2. *Student Responses (S-A)*

Based on the written test and subsequent interview, the analysis of Subject A (S-A) reveals a consistent pattern of difficulty in solving problems related to measures of central tendency.

- Question 1 (Mean): The student successfully identified the necessary data and the correct formula. However, they made significant procedural errors during the calculation phase and were unable to formulate a final conclusion based on their results.
- Question 2 (Median): S-A understood the question and could verbally define the median as the "middle value." Despite this conceptual knowledge, they expressed a lack of confidence and were unsure about their final answer.
- Question 3 (Mode): Similarly, the student understood the concept of **mode**. However, they were again uncertain about the correctness of their answer and did not provide a concluding statement.

Conclusion for Subject A: This pattern suggests that S-A's primary challenge is not a lack of conceptual understanding, but rather a weakness in **procedural skills and confidence**. While the student grasps the basic definitions of mean, median, and mode, they struggle with accurate calculation, verification of their work, and the ability to draw firm conclusions.

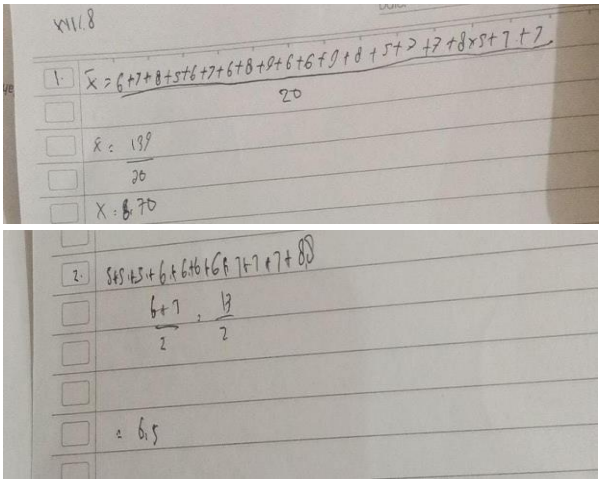


Figure 3. *Student Responses (S-B)*

The analysis of the written test and interview with Subject B (S-B) indicates challenges in both comprehending the questions and clearly articulating a solution.

- Question 1 (Mean): The student could state the objective to find the average score but was unable to identify the relevant data within the problem. Consequently, they were unsure how to determine the necessary steps to solve it and could not draw a conclusion.
- Question 2 (Median): S-B successfully identified the known data (scores and number of students) and understood that the task was to find the **median**. However, they lacked confidence in their answer and could not explain the calculation process they used.

Conclusion for Subject B: This student demonstrates a limited understanding of basic statistical concepts, particularly in processing data and forming conclusions. The difficulties suggest a need for targeted guidance on interpreting problems, applying procedural steps correctly, and systematically presenting results. The error made by Subject B, applying an even-data formula to an odd-data set, signifies a disconnection between **procedural and conceptual knowledge**. The student relied on a memorized procedure (instrumental understanding) without comprehending the fundamental concept of the median (relational understanding). This suggests that the student views statistical formulas as

arbitrary rules rather than logical mathematical tools.

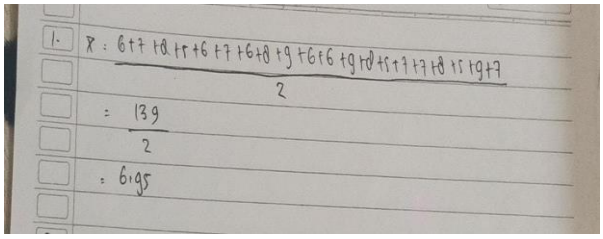


Figure 4. *Student Responses (S-C)*

The analysis of the written test and interview with Subject C (S-C), who represents the low-difficulty (high-performance) group, reveals a strong conceptual understanding of the topic.
For question number 1, the student demonstrated the ability to:

- Understand the question correctly.
- Identify all known data.
- Recognize the objective, which was to find the average value.
- Correctly identify the symbols and formulas needed.

The primary issue arose during the **calculation stage**, where a procedural error led to an inaccurate final result. Additionally, the student did not provide a concluding statement to summarize their answer.

Conclusion for Subject C: This student's conceptual understanding is quite good. The difficulty experienced is not related to grasping the concepts but rather to **procedural accuracy** and the final step of formally presenting a conclusion. This suggests that while the student understands the material, they need to improve their skills in careful calculation and finalizing their work.

Based on data analysis, it was found that student (S-A) made mistakes on questions 1, 2, and 3 when answering the three questions. The results of student (S-A)'s written test were compared with the interview results, and it was found that based on student (S-A)'s answer to question number 1, which asked them to determine the average value of the given data, it was clear that the student had written down all 20 data points completely. The initial steps of the work showed that the student understood that the data had to be added up first. This can be seen from the sum of all the data written as 139, which is the correct result.

However, an error occurred in the next step. The student divided the sum of the data by 2, instead of by the actual number of data points, which was 20. As a result, the student obtained a final result of 60, which is incorrect and illogical when viewed from the range of data values, which were all between 5 and 9. This error shows that the student does not yet understand the basic concept of calculating the average, which is that the total value must be divided by the number of data points (n). In addition, the student did not explicitly state the value of n, so the calculation steps were unclear and did not follow the correct mathematical modeling rules. This indicates that the student has difficulty with mathematical modeling, as they failed to correctly construct a mathematical representation of the given problem. Thus, it can be concluded that student (S-A) experienced two main types of difficulties in question number 1: (1) difficulty understanding the concept of average because they divided the data by the wrong number (not the number of data points). (2) Difficulty in mathematical modeling, namely compiling calculation steps and representations that do not follow the procedure.

In question number 2, students were asked to determine the median value of a set of data. Based on the answers provided, the students sorted the data correctly. There are 13 data points, and mathematically, the median of an odd number of data points can be determined, so the median value is the 7th data point in the sequence. However, the student's answer only shows the calculation 14 ÷ 2 = 7, without clearly stating that the number 7 refers to the median position in the data, and without mentioning the value of the 7th data point. The student did not complete the final step to find the actual median value, which is to take the 7th number from the sorted data. In fact, in this data series, the 7th value is 6, which should be the final answer.

This error shows that the student does not fully understand how the concept of median works in the context of odd data. In addition, the student did not write a conclusion or explain the answer completely, which is an important aspect of mathematical communication. Based on this, the

student (S-A) experienced two main types of difficulties, namely, (1) Difficulty in mathematical modeling because they did not connect the position of the median (7th data point) with the actual value in the data, and (2) Difficulty understanding the concept because they did not convey their thought process and conclusions completely and clearly in writing.

In question number 3, students were asked to determine the mode of a set of data, which is the value that appears most frequently. The question actually shows that the number 7 is the mode because it appears 7 times, more than any other number. However, from the answers provided, students copied the data incompletely. In their version, the number 7 only appears 4 times. In addition, the student marked the number 7 but wrote the number 6 as the answer, even though that number only appears 3 times. This shows a misunderstanding of the concept of mode, as well as difficulty in copying data and drawing the correct conclusions from the available information. Thus, it can be concluded that the student (S-A) experienced several difficulties, namely, (1) difficulty in understanding the concept, because they were unable to identify the mode value with the highest frequency, (2) difficulty in mathematical modeling, namely in copying or presenting data, which affected the entire process, (3) difficulty in drawing conclusions, because the student was inconsistent between the data analysis and the final answer.

These findings are in line with the results of research by Alivia Salsabilla Maharani, Siti Chotimah, and Eka Senjayawati in their study entitled “Analysis of Junior High School Students' Difficulties in Solving Statistics Problems.” In this study, it is explained that junior high school students experience various difficulties in solving statistics problems, including:

- Difficulties in understanding the questions and data provided.
- Difficulties in performing calculations, such as adding data or determining the median, mode, and mean.
- Difficulties in drawing conclusions from the calculation results.

Difficulty in choosing and applying problem-solving strategies.

For all questions answered by subject 2, there were two incorrect answers, namely questions 1 and 2. In question 1, students (S-B) were asked to calculate the average value of 20 data points. Based on the answers provided, students demonstrated a fairly good understanding of the steps to solve the problem. He wrote down the data completely and correctly, and applied the average formula appropriately, which is to add all the data and divide it by the number of data (n = 20). The total sum of the data was also correct, which was 139. However, the student made a mistake in the final calculation. He wrote down the result as 139 ÷ 20 = 6.70, when the correct result was 6.95. This error is classified as a numerical procedural error, which most likely occurred due to a rounding error or technical error when performing the division. In addition, the student did not write the conclusion in the form of a final sentence, such as “So, the average is...”. This shows a weakness in written mathematical communication, which is important in explaining mathematical thinking processes.

Thus, student (S-B) experienced two types of difficulties, namely (1) Calculation difficulties, namely errors in dividing and rounding the results. (2) Difficulties in drawing conclusions, namely not presenting the final results in the form of a conclusion or narrative.

In question number 2, student (S-B) was given data consisting of 13 numbers, which is an odd number. The median should be determined by taking the value in the 7th position, which is the number 6. However, the student applied the median formula for even data. Student (S-B) also included it but did not use it further in the calculation.

Thus, student (S-B) experienced three types of difficulties, namely (1) difficulty understanding the concept, where the student did not understand that the median for odd data can simply be taken from the middle data, (2) difficulty with mathematical modeling, where the student applied the wrong solution strategy, using the method for even data, (3) difficulty drawing conclusions, where students did not convey the

median results with a complete narrative or affirming sentence.

These findings are in line with the results of research conducted by Alivia Salsabilla Maharani, Siti Chotimah, and Eka Senjayawati in their study entitled “Analysis of Junior High School Students' Difficulties in Solving Statistics Problems.” The study explains that students face various difficulties, such as:

- Difficulties in performing arithmetic operations (addition, division) on statistical data,
- Errors in understanding basic concepts, such as determining the amount of data (n), mean, and mode,
- Carelessness in presenting answers, and
- Lack of understanding of the procedures for solving statistical problems comprehensively.

Thus, the results of this study reinforce that difficulties in calculation and understanding basic concepts are obstacles to statistics. This indicates the need for learning strategies that not only focus on technical procedures but also deepen understanding of the main concepts that junior high school students often experience in solving problems through contextual exercises and problem-solving-based learning.

For all questions answered by subject 3, there were 3 questions answered, namely numbers 1, 2, and 3. Student (S-C) only made a mistake on question 1. On question 1, Student (S-C) showed that he understood the basic structure of calculating averages, which is to add up all the data first. They copied and wrote down 20 numbers correctly, and the sum was accurate, namely 139. Up to this stage, the student demonstrated good data representation and initial processing skills. However, an error occurred when the student determined the divisor in the average formula. He divided the total of 139 by 2, instead of by the number of data points, which is 20. Although the final result is 6.95, which is indeed the average of 139 divided by 20, the student obtained this number from an incorrect division (139 ÷ 2). This means that the result is correct by chance, but the process and understanding are incorrect.

This error shows that the student does not yet fully understand the meaning of “number of data points” in the context of averages, and how the formula should be used according to the number of observations.

In addition, the student did not write the conclusion in the form of a final sentence, which is important in showing that he is able to convey the results of problem solving clearly and communicatively.

Thus, the student (S-C) experienced three types of difficulties, namely (1) Difficulty Understanding Concepts, where the student misunderstood the meaning of the divisor in the average formula. He did not associate the amount of data (20) as the correct divisor, (2) Difficulty in Mathematical Modeling, where the student failed to form an appropriate mathematical model from the context of the question. They wrote a mathematical model that did not match the amount of data given, (3) Difficulty Drawing Conclusions, where students did not provide a final statement or confirmation of the results obtained. This shows a lack of written mathematical communication skills.

These findings support the results of research by Alivia Salsabilla Maharani, Siti Chotimah, and Eka Senjayawati in their study entitled “Analysis of Junior High School Students' Difficulties in Solving Statistics Problems.” In that study, it was mentioned that one of the difficulties often experienced by students was:

- Errors in calculation, even though the procedure was carried out correctly.
- Carelessness in the calculation process, which led to inaccurate final results.
- Difficulty in maintaining consistency between the procedure and the calculation of numbers.

In this context, the mistakes made by S–C students prove that procedural understanding alone is not enough, as accuracy and good calculation skills are still needed to obtain correct final results.

Thus, these results reinforce the findings of previous studies that calculation errors remain a major obstacle, even for students who have understood and compiled the steps correctly. This shows the importance for teachers to not only assess students' procedural understanding, but

also pay attention to the aspects of accuracy and precision in calculations in statistics learning.

5. Conclusion

This study concludes that while calculation errors are prevalent, the root cause of student difficulty lies in **Mathematical Modeling**. Specifically, students fail to transform raw data into appropriate mathematical models. A key insight offered by this study is the distinction in error types: high-ability students tend to make 'procedural slips' due to lack of verification, whereas low-ability students suffer from fundamental 'conceptual gaps' preventing them from initiating the problem-solving process correctly. The analysis revealed a range of specific errors. These included fundamental conceptual mistakes, such as using the wrong divisor when calculating the mean; procedural errors, like failing to distinguish between the median's position and its actual value; and basic data handling errors, such as incorrectly copying the data provided. A consistent weakness observed across all subjects was the failure to formulate a clear, written conclusion for their answers.

In general, the subjects have not fully mastered basic statistical concepts and struggle to apply appropriate problem-solving strategies. They also demonstrate weaknesses in communicating their results mathematically. Therefore, there is a clear need for instruction that emphasizes deep conceptual understanding, procedural accuracy, and training in written mathematical communication to help students overcome these difficulties.

Based on the research findings, the following suggestions are proposed:

For Educators

- It is recommended that teachers place a greater emphasis on teaching basic statistical concepts in a contextual and gradual manner. Special attention should be given to distinguishing between solution strategies for different data types (e.g., odd vs. even sets for the median).
- Teachers should guide students to write out the complete solution process and a final conclusion. This will help develop their mathematical communication skills.
- The use of open-ended questions and reflective exercises is encouraged to help teachers identify and correct students' misconceptions early on.

For Students

- Students need to focus on improving their understanding of basic statistical concepts and develop the habit of thoroughly checking each step of their work.
- It is advised that students actively ask questions when they have difficulty understanding formulas or procedures.
- Practicing the ability to explain results in writing is important, ensuring that answers are not only numerically correct but also logical and communicative.

For Future Researchers

- Future research could expand the number of subjects to include more students from various ability levels, making the results more representative and generalizable.
- Further studies could also investigate other factors that influence learning difficulties, such as student motivation, learning strategies, and mathematical thinking styles.
- Research could be broadened to include other mathematics topics to gain a more comprehensive picture of learning difficulties in the subject as a whole.

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