

## **ANALYZING STUDENTS' DIFFICULTIES IN SOLVING PROBABILITY PROBLEMS (CASE STUDY IN THE FIRST GRADE OF SENIOR HIGH SCHOOL**

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### **ABSTRACT**

Learning difficulties are disturbances or obstacles resulting in less-than-optimal learning outcomes. Analysing student difficulties can be done by re-examining student work and asking students to explain how they solve math problems through interviews. This study aimed to describe students' difficulties in solving probability problems of first-grade high school students. This type of research is descriptive qualitative. The subjects of this study were 20 students from two high schools in Banda Aceh. Data collection techniques in this study used tests, interviews, and documentation. The subject selection technique was based on the answers to the subject questions that were wrong and considered interesting to explore further and the subjects who could provide the most information so 2 subjects were obtained from the participants. From the data analysis and discussion results, it can be concluded that students' errors in solving probability material were caused by a lack of understanding of the concept of using and applying formulas. The cause is that students are not careful and cannot understand the meaning of the question.

**Keywords:** *Probability, student difficulties, mathematics.*

### **INTRODUCTION**

Education is one of the strategic efforts to enhance the nation's life and advance the country. As a main pillar of development, education not only aims to improve individual quality but also to produce a generation capable of bringing about positive change. In the face of globalization and rapid technological advancement, the quality of human resources produced by

education will significantly determine a country's competitiveness. To achieve quality education, equal access for all citizens is crucial, ensuring that every individual has the opportunity to develop and contribute in various aspects of life.

Mathematics is a scientific discipline that plays a strategic role in the education system. As a universal language, mathematics serves as the foundation for the development of science, technology, and problem-solving across various fields. Mathematics education equips students with skills such as: (1) solving problems both in mathematics and in real life, (2) connecting various concepts, and (3) developing logical, critical, systematic, and objective thinking patterns. However, in reality, mathematics is often perceived as abstract and difficult to understand. This perception leads students to feel pressured while studying, which negatively impacts their learning achievement and ability to grasp other mathematical concepts.

One of the mathematical topics that often poses a challenge for students is probability. As a branch of mathematics, probability plays an important role in both learning and real life, including data analysis, weather prediction, risk assessment, and the development of artificial intelligence. This topic teaches how to assess the likelihood of an event occurring, which has broad applications in everyday life. However, despite its significance, students' understanding of probability is often low. Research shows that students experience various difficulties in understanding probability, such as describing sample spaces, structuring experimental events, creating mathematical models, and grasping the principles of probability. These difficulties are often caused by a lack of mastery of prerequisite concepts and weak connections to real-world applications. Internal factors, such as motivation and abstract thinking abilities, as well as external factors, like less contextual learning methods, also influence students' challenges.

Given the important role of probability in education and life, an innovative and contextual learning approach is needed that focuses on developing conceptual understanding. This approach will help students overcome learning barriers, enhance their understanding, and prepare them to face the challenges of the modern world. However, considering students' low understanding of probability material, this research aims to analyze the difficulties students encounter when solving mathematical problems related to probability. Specifically, this research will answer two problem formulations: (1) What types of difficulties do students experience in solving mathematical problems on probability material? and (2) What kind of learning strategies can be applied to overcome students' difficulties in solving mathematical problems on probability material? By understanding the types of difficulties experienced by students and identifying learning strategies that can be applied, it is hoped that the results of this research can contribute to improving the quality of mathematics learning. Apart from that, it is also hoped that this research can provide practical recommendations for teachers and policy makers to design

more effective and relevant learning strategies, so that students are not only able to understand the concept of opportunity academically but also apply it in everyday life.

## **METHODS**

This type of research is qualitative because the data analysis is descriptive and non-statistical. The research method used is descriptive, as the data produced consists of written and spoken words obtained through observation. In this study, the researchers did not manipulate or apply any specific treatments to the research subjects; all activities or events proceeded as they naturally occurred. The data sources in this research were obtained from test results, interviews, and research documentation. The documentation of test results includes students' work in solving questions on probability material. The test questions used are presented in Chapter III. Interviews were conducted by the researchers with students from Banda Aceh High School in Class X. Documentation was in the form of photos.

Validity checks in this research used triangulation techniques. According to Moleong (2011:330), triangulation is a data validity checking technique that utilizes something other than the data for checking purposes or as a comparison of the data. In this research, the type of triangulation used is triangulation with data sources applied to ensure the validity and reliability of research results, by comparing findings from test results, interviews and observations. The collected data was analyzed using thematic analysis techniques to identify patterns of errors and factors causing student difficulties. This research aims to provide a comprehensive picture of student difficulties, so that it can become a basis for designing more effective learning strategies in probability material.

## **RESULTS AND DISCUSSION**

In this section, the results of the description of student errors in solving probability material questions and their causes are presented, which were made by two subjects out of 20 research subjects. The probability material questions consist of one question that is done by class X high school students. We can see that some students have difficulty understanding the basic concept of probability. Question:

Three students named Nisa, Rio, and Riko were chosen to be OSIS administrators out of a total of 8 students. What is the probability that Nisa and Riko were elected as administrators, but Rio was not elected?  
The following is a description of students' problems in solving probability problems.

1) Student A

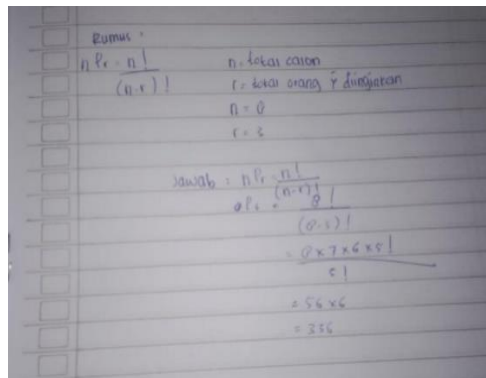


Figure 1

Based on student A's test answer in Figure 1, the student's answer is wrong because the student used the formula incorrectly. We can see from this question that it is an example of a combination, while student A used a permutation formula, so the student doesn't understand the concept so he can't differentiate between combination and permutation. The following is an excerpt from the researcher's interview with student A regarding the answer above.

Researcher: "Why did you use the permutation formula for that problem?"

Student A: "I think the order of election is important because we elect 3 people to the board, so I think maybe it is related to permutations."

Based on a short interview excerpt, student A experienced confusion when working on questions due to incorrect use of concepts or formulas, student A was unable to differentiate between permutations and combinations. The mistake students make in solving the problem is using the wrong formula, the problem should have used the combination formula  $C(n,r)=n!/r!(n-r)!$  Meanwhile, students create a permutation formula  $P(n,r)=n!/(n-r)!$ .

2) Student B

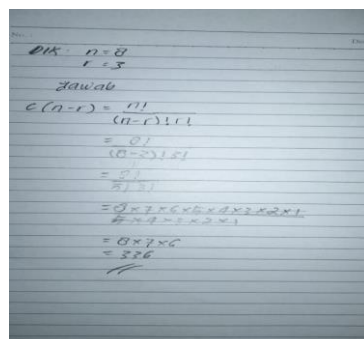


Figure 2

Student B's answer was correct using the combination formula, but student B was wrong when adding in the fourth row because he didn't subtract  $3!$ . Immediately spells out  $5!$ , so  $3!$  He doesn't use it anymore. The following is an excerpt from the researcher's interview with student B from the answer above.  
 Researcher: "Why don't you use 3 in the fourth line! The?"  
 Student B: "I'm sorry ma'am, I thought  $3!$  It is no longer used because it was on  $5!$ "

From the results of the researcher's interview with student B, he did not realize that his answer was wrong in the fourth part. The student thought it was  $3!$  This is not explained further because it is already in  $5!$ . Even though it's  $3!$  This still needs to be explained.

## CONCLUSION

Based on the analysis of the results and discussion of the research, it can be concluded that students have difficulty in solving probability problems. Two main types of errors can be identified by the two research subjects, namely Student A and Student B.

1. Conceptual Error:

- a) Student A experiences conceptual confusion in distinguishing between permutations and combinations. As a result, student A uses the permutation formula  $P(n,r)=n!/(n-r)!$  to solve problems that should be solved with the combination formula  $C(n,r)=n!/r!(n-r)!$ .
- b) This shows that student A does not yet understand well when to use permutations (when order is important) and when to use combinations (when order is not important).

2. Operational Error:

- a) Student B has understood the concept correctly and used the correct combination formula.

However, student B made an operational error in the fourth calculation line, namely not dropping  $3!$  in the calculation. Student B thought that  $3!$  was already included in  $5!$ , so this part was ignored, which caused the final answer to be wrong.

The errors made by both students indicate that in addition to understanding the concept, operational ability in applying formulas is also an important aspect in solving probability problems. To improve student

- a) Student A needs to be given additional explanations about the basic differences between permutations and combinations, including example problems that help them identify when order is important or not.
- b) Student B needs to be given exercises that focus on correct calculation procedures, especially in lowering the complete factorial to avoid similar operational errors in the future.

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