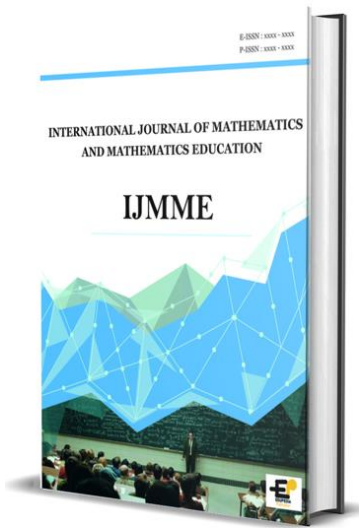

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Abstract

Mathematical story problems in the opportunity material are a form of questions that present mathematical problems related to everyday life in the form of stories. This research aims to describe the difficulties experienced by students in solving mathematics story problems on opportunity material. The type of research used is a descriptive method with a qualitative approach. The study involved 30 students. Data were collected using a combination of tests and student interviews. The overall research procedure involved three stages, namely the planning stage, implementation stage, and conclusions. Data were analysed using descriptive statistics. The results of this study show that students experienced difficulties in solving mathematics story problems on opportunity material, especially in understanding the problem (33,33%), carrying out transformations (36,66%), processing skills (38,88%), and difficulty in drawing conclusions (51,11%).

Introduction

Mathematics is the science of the universe or everything related to the universe (Trygu, 2020). Mathematics is a science that can be found anywhere and at any time (Zebua, 2022). Mathematics is a universal science because it plays a role in many branches of science (Akbar et al., 2018). Mathematics is an abstract science so it requires logical thinking and strong understanding (Handayani and Aini, 2019). Mathematics actually approaches reality with general concepts built from logic (Ihsan, 2023). Mathematics is one of the lessons that is always present at every level of education. Mathematics is very important because it cannot be separated from its diverse functions in various aspects of life (Tadris, 2020).

Mathematics learning is a learning process that teaches students to understand the nature of mathematics (Kenedi et al., 2018). Mathematics learning aims to increase knowledge in mastering mathematics material (Pandiangan, 2020) and mastering basic concepts in order to understand the material (Juliati, 2021). Opportunity material is one of the topics in mathematics learning at school in many educational system (Mardianto et al., 2023). Opportunity is a component that collects, classifies,

analyzes and explains the probability of unknown events and unexpected situations (Purnama et al., 2020). Students are taught the concept of probability rules without having to memorize the formula (Setiani et al., 2022).

Indonesia has taken the Program for International Student Assessment (PISA) test designed by the Organization for Economic Co-operation and Development (OECD). The 2022 PISA test results show that Indonesian students' mathematics scores fell by 13 points when compared to the 2018 PISA test results, namely from 379 points to 366 points. Even so, Indonesia's ranking in PISA 2022 rose 5-6 positions compared to 2018 (Kemendikbud, 2023). Apart from that, Indonesia did not participate in the 2019 Trends in International Mathematics and Science Study (TIMSS) organized by the International Association for the Evaluation of Educational Achievement (IEA), but was based on the 2015 TIMSS results according to Nizam in Hadi and Novaliyosi (2019) Indonesia is in a low position, only getting a mathematics score of 397 points and ranking 44 out of 49 countries. Based on the 2019 list of regional and educational unit scores accessed on the Center for Educational Assessment website, the average score for the SMA/MA IPS National Examination in mathematics in Indonesia is still relatively low because it only got a score of 34,17. From this it can be concluded that Indonesia's ranking in PISA 2022 has increased, but mathematics achievement in Indonesia is still relatively low.

The difficulties experienced by students in studying mathematics make students experience failure in solving problems related to mathematics (Sinaga and Sinaga, 2017). Students still make many mistakes in solving questions on opportunity material (Zainudin et al., 2021). Opportunity material is one of the materials that is classified as difficult for students in solving story problems (Sinaga et al., 2021). Students' difficulty in solving questions is due to their lack of understanding the material and the solution method presented by the teacher (Putridayani and Chotimah, 2020). Students still have difficulty understanding the basic concepts of problems related to opportunities, such as practice questions given to students in story form (Finariya et al., 2023). Also, students find it difficult to apply the concept of opportunity to solving everyday problems (Maharani et al., 2022) due to the teacher's instructional approach of taking notes on the balckboard (Jamal, 2014).

In teaching mathematics, teachers should pay more attention to the learning difficulties experienced by students (Utari et al., 2019). It would be better if word problems were given frequently and the question models had to be varied so as to hone students' abilities and reduce errors in working on math story problems (Indriani, 2020). An alternative solution to this error is to increase students' understanding of using formulas, they even need detailed knowledge of where the formula comes from and how it is applied in everyday life, in order to minimize these errors, students must really master the material being studied (Khasanah and Sutama, 2015). By providing more intensive story problem practice, teachers can improve students' difficulties in solving story problems (Tanzimah and Sutrianti, 2023). That way, teachers need to increase students' understanding of opportunity material (Zainudin et al., 2021).

Indriani (2020) research states that students still have difficulty solving mathematical problems in

word problems, especially opportunity material. Such findings are supported by Putridayani et al (2020) who noted that students who have difficulty are less able to solve questions correctly. This is in accordance with research conducted by Mardianto et al (2023) that students' difficulty in answering story questions on probability material is that students are still not very thorough in analyzing the questions, determining the sample space, determining the probability of event members, and some mistakes calculations and incorrect simplification of opportunity values. According to Saniyah and Alyani (2021) there are students' learning difficulties in understanding the concept of opportunity, so that students do not plan solutions well. Fitri and Abadi (2021) research revealed that the types of difficulties experienced by students in solving problems are related to opportunity material, namely difficulty understanding the problem, carrying out transformations, process skills, and drawing conclusions. Based on the given description, this research aims to describe the difficulties experienced by students in solving mathematics story problems on opportunity material. With this research, it is hoped that we can find out the difficulties experienced by students in solving story problems on mathematics material, especially on opportunity material.

Method

This research applied the descriptive methods with a qualitative approach. Descriptive research was carried out to describe and provide an overview of an existing phenomenon by considering in more detail the relationship between its characteristic aspects (Sarosa, 2021). This research was conducted in April 2024 at SMA Negeri 2 Pekanbaru in the 2023/2024 academic year. The participants in this research were 30 students of class XII IPS 2 SMA Negeri 2 Pekanbaru. The study used a purposive sampling technique to study the student experince with solving story material questions. Purposive sampling was suited to this study because it leads to regional or stratum participants based on considerations that focus on certain objectives (Sahir, 2021). The general research procedure consisted of three stages, namely: 1) planning stage, at this stage the researchers examined problem identification, problem formulation, literature review, and methods used in research. The researchers also determined the research subject and prepared research instruments consisting of tests and interviews which then asks for criticism and suggestions from experts for improvement; 2) implementation stage, was carried out by researchers by giving questions and asking students to work on these questions in order to find out the difficulties experienced by students during the test and conducting interviews to obtain information regarding the difficulties they experienced when completing the story questions given; 3) conclusion, at this stage the researchers drew conclusions from the results and discussion that have been obtained.

Data collection techniques in this research were carried out using tests and interviews. Tests were used to collect data on students' answers and steps in solving problems. Meanwhile, interviews were used to find out the difficulties experienced by students while taking the test. The research instrument was used was in the form of the story questions with indicators of difficulty in them, namely difficulty understanding the problem, difficulty carrying out transformations, difficulty processing skills, and difficulty in drawing conclusions. Also, data analysis techniques were used to analyze students'

difficulties in solving mathematics story problems on opportunity material. The data analysis technique used in this research involved three stages, namely: 1) Reducing the data, at this stage the researcher analyzed the data by analyzing the answers to the questions given to students and also assisted with interviews to determine the difficulties experienced by the students; 2) Presentation of data, the results of the analysis carried out by the researcher are then presented in the form of narrative text and a presented table of analysis results; 3) Conclusion, is drawing conclusions from data that has been obtained in the data reduction and presentation process. Next, the researcher processed the data using the percentage formula used by Jamal (2014) as follows:

$$P = \frac{F}{N} \times 100\%$$

Information:

P = Percentage of answers

F = Frequency of student difficulties

N = Total number of students

Data analysis was carried out based on Newman's difficulty indicators in research conducted by Fitri and Abadi (2021). The following is a related explanation regarding indicators of students' difficulties in solving mathematics story problems.

Table 1. Indicators of Difficulty in Solving Mathematics Story Problems

No	Stage Analysis	Difficulty Indicator
1	Difficulty Understanding the Problem	Students do not write down the information they know and are asked in the question.
		Students write down information that is known and asked in the question but is not accurate.
2	Difficulty Carrying Out Transformations	Students do not change the problem into a mathematical model.
		Students change the problem into a mathematical model but it is not quite right.
3	Difficulty Processing Skills	Students make mistakes in the calculation process.
		Students are inaccurate in explaining the calculation process and do not continue with the completion steps.
4	Difficulty Drawing Conclusions	Students do not write final answers/conclusions.
		Students write final answers/conclusions but they are not quite right.

Results and Discussion

Based on the results of the answers related to the questions that have been given to students in solving mathematics story problems on opportunity material, can be seen in Table 2 below.

Table 2. Student Difficulties in Solving Mathematics Story Problems

Question Items	Frequency of Student Difficulties	Percentage
1	17	56,66%
2	8	26,66%
3	10	33,33%

It can be seen in Table 1 that the ratio of students who answered correctly in question number 1 was very low, when compared with students who answered correctly in question number 2 and 3. In question item number 1, the percentage of each question item was 56,66% of students who difficulty in working on the questions or 17 students who had not been able to solve the story questions on the opportunity material correctly. In question item number 2, the percentage of each question item was 26,66% of students who found it difficult to solve the story questions or as many as 8 students had difficulty solving the questions given. Furthermore, in question item number 3 there were 10 students who found it difficult to solve the problem or as many as 33,33% of students had difficulty working on the opportunity story problem.

From the results of the analysis of student answers, the percentages obtained for each type of difficulty for each question item are presented in Table 3 below.

Table 3. Percentage of Student Difficulties Based on Indicators

Type of difficulty	Many Students Experience Difficulty with Questions			Total	Percentage
	1	2	3		
Understanding the Problem	16	9	5	30	33,33%
Carrying out Transformation	14	8	11	33	36,66%
Process Skills	17	8	10	35	38,88%
Draw a conclusion	19	10	17	46	51,11%

From the results of this research, it can be concluded that difficulty in drawing conclusions is the type of difficulty with the highest percentage, namely 51,11%. This shows that the majority of students have difficulty writing conclusions or think that not writing conclusions is normal and they should be forgiven for forgetting, because according to them if they have done the calculations correctly it means they have answered and completed the story questions given. Furthemore, the difficulty of process skills has a percentage of 38,88%. This is because students experience difficulty in determining the steps to be taken, carrying out the calculation process, and continuing the settlement procedure. Students do not use appropriate steps in determining the probability and expected frequency of an event, have difficulty carrying out the calculation process or make mistakes in the calculation process and do not continue the work they have done.

The difficulty of carrying out the transformation has a percentage of 36,66%. In this case, students experience difficulty in changing the information provided in the form of story problems into the form of an appropriate mathematical model, such as not making a mathematical model of the number of events, sample points, expected frequency, probability of an event, and not using the right formula. In addition, difficulty understanding the problem has a lower percentage, namely 33,33%. The difficulty experienced by students in this case is writing down information that is known and asked in the question but is inaccurate or does not write down any information at all. However, it is important to continue to pay attention to students' ability to understand the issues and nature of the problems contained in the story problems.

To further explore the difficulties experienced by students, researchers also interviewed students about these difficulties. This is done to ensure that the results of the analysis of student difficulties are in accordance with the student's actual understanding and intentions. Therefore, this research provides useful insight into the various difficulties that students usually experience when solving mathematical story problems on probability material. The following is an analysis of students' answers when working on math story problems on opportunity material with the difficulties they experienced.

Question 1

A family wants to have 4 children. The probability that the family has at most 1 daughter is . . .

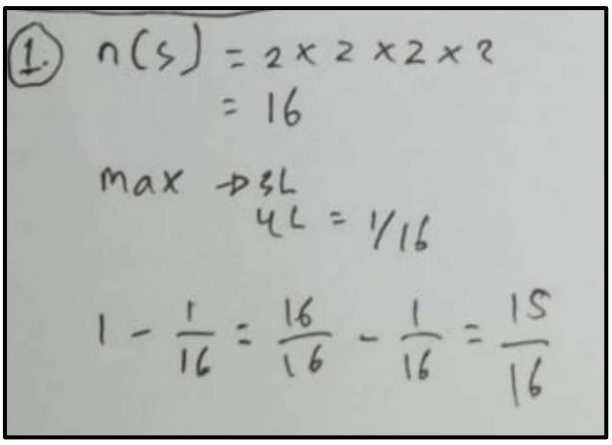

Figure 1. Students' Answers to Question Number 1

From the results of students' answers in Figure 1, it can be seen that students felt difficulty in solving story problems on the opportunity material provided. The difficulties experienced by these students start from their difficulty in understanding the problem. Where the student did not write down what information he knew and what was asked from the question given, namely that he wanted to have 4 children with at most 1 daughter. According to Tanzimah and Sutrianti (2023) students must learn to identify the information given in the question, both information that is known and that which is asked. This can help students' difficulties regarding understanding the problem in solving mathematics story problems on opportunity material.

The next difficulty experienced by students is difficulty carrying out transformations, this can be seen from the answers of students who have difficulty converting into mathematical models. The answers written by students are not accurate in determining the number of events and sample points in the questions given. Students should first create a mathematical model to determine the members of the sample space and then determine the number of events from 4 children with at most 1 daughter. In this case, students think that at most 1 daughter means there is only 1 incident, when in fact with at most 1 daughter it means there are 5 incidents. According to Sinaga and Sinaga (2017) when solving story problems, students often have difficulty translating the story problems into mathematical models, because students are more often faced with mathematics problems that have been formulated mathematically.

Furthermore, students have difficulty in processing skills when carrying out calculations or are not precise in the calculation process. Because previously students had difficulty in carrying out transformations, the result was that students made mistakes in carrying out the calculation process. The probability of wanting to have 4 children with at most 1 daughter should be $\frac{5}{16}$. According to Prihartini et al (2020) the skill of calculating opportunities is very important to find the probability of an event occurring.

The final difficulty experienced by students was difficulty drawing conclusions, where students did not write the final answer as intended in the question given. Students must immediately write down the results of the calculation process carried out previously without drawing conclusions from what they have made. According to Muslim et al (2022) in this case, students did not write conclusions because they were not used to it and were in a hurry to do the questions so they forgot to write conclusions.

Based on the results of the students' answers above, researchers conducted interviews to find out the difficulties experienced by these students. Below is an interview with the student.

Researcher: "Why don't you write down the information from the questions given first?"
Student: "Because I'm used to answering directly, sis."
Researcher: "Do you know the members of the sample space of events in question?"
Student: "I think there is only 1 member from the sample room you asked about."
Researcher: "Why don't you use the probability formula to do it?"
Student: "Because I don't know, sis."
Researcher: "Do you know the consequences of the mistakes you make?"
Student: "I know sis, as a result, I didn't answer the question correctly."
Researcher: "Then why don't you write down the conclusion of the work you did?"
Student: "I forgot sis, because I did it quickly."

Based on the interview, students did not know how to translate story problems into mathematical form, did not use the correct formula, and did not draw conclusions from the work they did. So the answers produced by students do not correctly answer the questions given.

Question 2

A dice is thrown 216 times. The frequency of occurrence of an even number on the dice is . . .

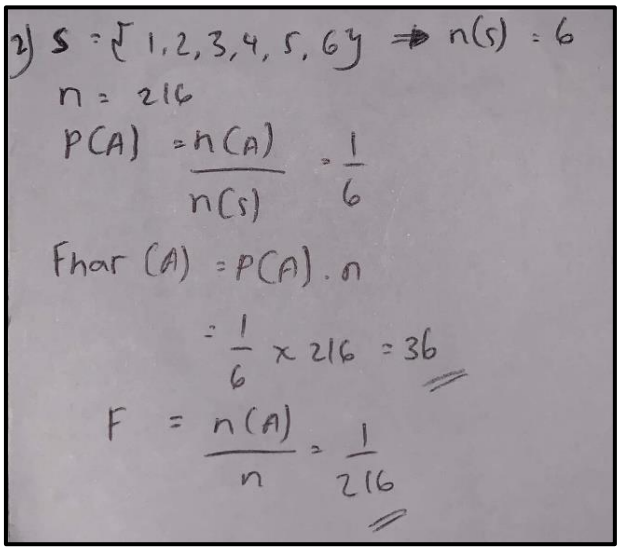

Figure 2. Students' Answers to Question Number 2

Based on the results of students' answers in Figure 2, students experienced several difficulties in solving the story problems given. The first difficulty is difficulty in understanding the problem, where students should write down what they know and ask questions. In the students' answers, it can be seen that students are not precise in writing down what they know. The student only wrote down the number of samples and the number of experiments. Students should also write down the number of times an even number appears on a dice. The fact that students found difficulties in determining what they knew and asked was expressed by Cooney in Fitri and Abadi (2021) that some students tend to memorize principles as facts, meaning that students only read the questions but are not able to understand the information contained in the questions.

The next difficulty is transformation difficulty, where students experience difficulty in determining the steps and make mistakes in using formulas. In this difficulty the student is correct in using the probability formula, the student understands what formula he is using. It's just that the student had difficulty making a mathematical model of the number of events where even numbers on a dice appeared. Students should write A = The event that an even number appears on a dice. A = {2, 4, 6} so we get $n(A) = 3$. According to Islamiyah et al (2018) if students have not mastered the determination of the number of sample points and sample space well, it will cause students difficulty in solving story problems on opportunity material.

Furthermore, students often experience difficulties with process skills. The process skills here are the mistakes made by students in solving opportunity material story questions when continuing the solving steps and carrying out calculations. It can be seen from the students' answer that he was wrong in determining the value for the number of events where an even number on a dice appeared. As a result,

the probability of the event not answering the given question correctly should be $P(A) = \frac{n(A)}{n(S)} = \frac{3}{6} = \frac{1}{2}$. So, in determining the frequency of these events students make mistakes in the calculation process because they have made mistakes in the previous process. To determine the frequency of this event, we can enter the value we have obtained into the formula $F(A) = P(A) \times n$, namely $F(A) = \frac{1}{2} \times 216 = 108$. According to Putridayani and Chotimah (2020) this comes back to students who do not understand the concept of opportunity material well so that the results obtained by many students are still inaccurate.

The final difficulty is the difficulty in drawing conclusions that is most often experienced by students. In the student's answer, he did not draw conclusions from the results of the work he had done. According to Sudiono (2017) students do not write the final answer because they feel they have been able to complete the solution correctly or conclude a final answer that is not appropriate to the context of the question.

Based on the results of the students' answers, researchers conducted interviews to explore the difficulties experienced by the students. Below is an interview with the student.

Researcher: "Why are you wrong in determining the number of events where even numbers appear on a dice?"

Student: "Because I didn't understand the meaning of the question, I was careless in answering it, sis."

Researcher: "Do you know the consequences of the mistakes you make?"

Student: "I know sis, as a result, I didn't answer correctly the frequency of events in the story question, sis."

Researcher: "Why don't you write a conclusion?"

Student: "Because if I just answer that, it's enough for you to answer the question given."

Based on the interview, students' lack of understanding regarding opportunity material was due to not being able to determine the number of events of an opportunity, which resulted in students having difficulty solving math story problems in the opportunity material.

Question 3

Dinda took the exam to accept new students at a university. It is known that the number of participants who took the test was 11.400 people and the frequency of new students being accepted was 8.400 people. How many opportunities does Dinda have to pass the exam?

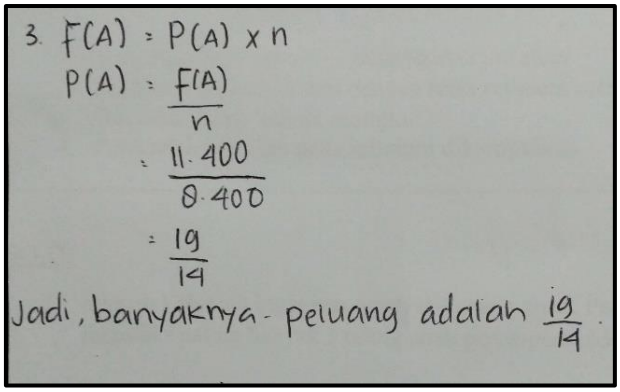

Figure 3. Students' Answers to Question Number 3

Based on the results of student answers in Figure 3, students still have difficulty understanding the problem, namely not being able to determine what information is contained in the problem (as known and asked). Students do not write down the number of participants who take part and the frequency of expectations as is known and how many opportunities are as asked in the question. According to Ardani and Nurkhafidhoh (2021) difficulties in understanding problems are caused by students not being able to capture information well, namely not being able to know what is known and asked in the question.

Furthermore, there is difficulty in carrying out transformations where students are able to determine what steps must be taken to solve the problem given but students are still wrong in determining the formula used. It can be seen from how the student answered the question, namely that it should have been solved using the formula $P(A) = \frac{F(A)}{n}$, but instead the student wrote the correct formula in reverse. According to Zaidy and Lutfianto (2016) difficulties in carrying out transformation occur when students are unable to determine the right way to organize information that suits the problem.

The next difficulty experienced by students is process skills, this is because students have used the previous formula incorrectly. As a result, the results of the calculations carried out by students did not answer the given story questions correctly. The correct answer to this question should be $\frac{14}{19}$. Students have difficulty carrying out transformations so that students make repeated mistakes in process skills. According to Syakur et al (2021) these calculation errors are because students have difficulty mastering the probability material and are less careful when working on the story problems given.

The difficulty that often occurs among students is drawing conclusions, where students write incorrect final answers. This is due to students' difficulties in previous process skills. From the questions given, students should be able to draw the conclusion that the number of opportunities is $\frac{14}{19}$. According to Fitri and Abadi (2021) students are able to draw conclusions if they are not wrong in determining the final answer and can write the answer accurately and correctly.

Regarding the results of students' answers, researchers conducted interviews to confirm the difficulties experienced by these students. Below is an interview with the student.

Researcher: "From that question, what do you know?"
Student: "Told to look for opportunities, sis. In the question, you know the frequency of students being accepted and the number of participants, sis."
Researcher: "That means you know what you know and are asked, why don't you write it down?"
Student: "Because I forget and am used to immediately writing down the answer, sis."
Researcher: "Do you think the formula used is correct?"
Student: "My formula is backwards sis, I wasn't careful enough and was in a hurry to do it, sis."
Researcher: "Do you know the consequences of the mistakes you make?"
Student: "I know sis, the consequences are wrong in determining the final answer in your conclusion, sis."

Based on the interview above, the causes of students' difficulties or mistakes are forgetting and getting used to writing answers straight away, not being thorough and rushing through questions. So students are wrong in drawing conclusions or final answers because of the difficulties they experience.

Conclusion

Based on the results of the research and discussion, it can be concluded that students still experience difficulties in solving mathematics story problems, especially in probability material. The percentage of each difficulty experienced by the students was 33,33% difficulty understanding the problem, 36,66% difficulty carrying out transformations, 38,88% difficulty processing skills, and 51,11% difficulty drawing conclusions. The difficulties experienced by students are difficulty in understanding the concept and translating story questions into probability material, difficulty in determining the number of events, sample points, expected frequency, probability of an event, and the use of inappropriate formulas.

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