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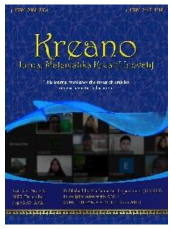

Analysis of Location and Causes Of College Students' Errors In Probabilistic Problem Solving

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Abstract

Problem solving is a necessity for college students, including probabilistic problems. However, student errors in solving these problems continue to occur, necessitating an analysis of the location and causes. The goal of this research is to identify the locations and causes of probabilistic problem-solving errors. This is a qualitative research. The study's subjects were nine students from Semarang State University's Mathematics Education Study Program with low Student Academic Ability (SAA). Based on the subject's problem-solving outcomes, the location and sources of errors in solving probabilistic issues using the Newman Procedure were thoroughly investigated. Data analysis starts with minimising data, then presents data, and finally draws conclusions. Checking the validity of the data using triangulation approaches, such as comparing test results to interview findings and comparing study subjects' outcomes. The findings of this study revealed that the research subjects made errors during the transformation, process skill, and encoding processes. Students' errors are caused by a lack of understanding of the strategy that must be employed in addressing probabilistic problems, topic confusion between the use of permutations and combinations, and confusion in identifying the sample space when taking one or more items in the experiment. The study's findings are likely to inspire and inform lecturers on how to use appropriate learning tactics to limit the possibility of student errors when tackling probabilistic questions. The conclusion of this research is that student errors in probabilistic problem solving lie in the transformation stage, the calculation process , and the error of writing answers so that it is necessary to be given the task of practicing probability problem solving in stages and there are brief instructions in developing a solution strategy.

Keywords: Error; Problem Solving; Probability; Newman Procedure.

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Abstrak

Pemecahan masalah sangat penting untuk dikuasai mahasiswa, salah satunya pada masalah probabilistik. Namun, masih sering dijumpai kesalahan mahasiswa dala menyelesaikan masalah tersebut, sehingga perlu dilakukan analisis letak maupun penyebabnya. Penelitian kualitatif ini bertujuan menganalisis letak serta penyebab kesalahan pemecahan masalah probabilistik. Subjek penelitian sebanyak 9 mahasiswa Pendidikan Matematika Universitas Negeri Semarang dengan Kemampuan Akademik Mahasiswa (KAM) rendah. Dari hasil pemecahan masalah subjek dieksplorasi secara mendalam letak dan penyebab kesalahan dalam memecahkan masalah probabilistik berdasarkan Prosedur Newman. Analisis data diawali reduksi data, kemudian penyajian data, dan diakhiri dengan penarikan simpulan. Pemeriksaan keabsahan data dengan teknik triangulasi yaitu membandingkan hasil tes dengan hasil wawancara, serta membandingkan hasil subjek-subjek penelitian. Hasil penelitian ini menunjukkan subjek penelitian mengalami kesalahan pada langkah transformation, process skill dan encoding. Adapun penyebab kesalahan adalah tidak mengetahui strategi yang harus digunakan dalam memecahkan masalah probabilistik, subjek kebingungan antara penggunaan permutasi dan kombinasi, kebingungan dalam menentukan ruang sampel antara pengambilan 1 objek dan beberapa objek dalam percobaan. Hasil penelitian ini dapat dijadikan dasar bagi dosen dalam menggunakan strategi pembelajaran yang tepat untuk mengurangi potensi kesalahan mahasiswa dalam menyelesaikan masalah probabilistik. Simpulan dari penelitian ini adalah kesalahan mahasiswa dalam pemecahan masalah probabilistik terletak pada tahap transformasi (transformation), proses perhitungan, dan kesalahan penulisan jawaban sehingga perlu diberi tugas latihan soal-soal pemecahan masalah probabilitas secara bertahap dan terdapat petunjuk singkat dalam menyusun strategi penyelesaian.

INTRODUCTION

Among the mathematical skills that must be given to students is problem solving ability (PSA). According to (Sala-Sebastià et al., 2022), problem solving is a process in which a person applies his knowledge, abilities, and understanding to solve a new problem whose solution is not yet known. PSA is a skill that college students to be able for 21st century challenges (Binkley et al., 2012). In the 21st century many problems contain uncertainty or contain elements of many possibilities where solving them requires thinking that involves probability or forecasting. Probability is part of a mathematical topic that studies solving problems that contain uncertainty.

Ability to solve probabilistic problems is an important component of mathematical literacy, as probability concepts have a role an integral in the decision-making process across a wide range of disciplines, including science, engineering, and social sciences. Probabilistic PSA as an ability that can develop students' ability to make appropriate decisions when facing problems in various situations. With a good understanding of probability will help a person in solving problems with little risk (Wijaya et al., 2021; Ingram, 2024). Seeing the importance of probabilistic problem solving skills, students need to be familiarized and trained to facing probabilistic problems to solve. This is also supported by Hebebci & Usta (2022), Kannan et al. (2016), Utari et al. (2019), Hartmann et al. (2022) who argue that problem solving skills need to be trained and developed in learning so that students are accustomed to using mathematical problem-solving thinking patterns in dealing with the realities of everyday life.

Seeing the importance of probabilistic PSA, this ability should be well able by students, but the facts in the field are not fully in line with expectations. The results of research that have been carried out Agoestanto et al. (2019, 2021), Haryati et al. (2016), Dewi et al. (2020), Ihtiani & Agoestanto (2021) show that students' PSA is not optimal and is classified as moderate and low. Previous research revealed that students have many challenges when solving probabilistic problems (Brückler & Šipuš, 2023, Hokor et al., 2021; Batanero &

Álvarez-Arroyo, 2024). These difficulties often come from conceptual misunderstandings, computational errors, and the inability to apply appropriate problem-solving strategies (Kaplar et al., 2021; Astuti et al., 2020).

The problem of suboptimal problem solving ability needs to be solved immediately. Students' obstacles in solving this probabilistic problem, if left unchecked will have an impact on the student's fluency when studying Mathematical Statistics courses, or other courses that require probability theory. In order to prevent these issues from happening again, the first step in resolving them is to identify the areas where students make mistakes and then determine the reasons behind their mistakes when addressing probabilistic situations.

Error analysis is often used in mathematics research, one of which is the Newman error analysis method. Newman's Error Analysis Procedure (NEAP) is a good framework for identifying and categorizing errors in mathematical problem solving (White, 2009; Alhassora et al., 2017). Newman divides errors made in problem solving into five types of errors namely: (1) Reading Error; (2) Comprehension Error; (3) Transformation Error; (4) Process Skill Error; And (5) Encoding Error. Hendricks & Olawale (2023) states that failure to complete one of the steps will result in mistakes that lead students' responses to differ from what they should.

Many studies have applied NEAP to various mathematical domains, but they tend to focus on broad mathematical competencies. The novelty of this research is that it focuses on understanding specific error patterns that are unique to probability. This study aims to (1) identify the areas where students with low student academic ability (SAA) make mistakes when solving probability issues and (2) identify the reasons why low SAA make mistakes when solving probabilistic problems.

METHOD

A qualitative research approach was applied in this study. The study was conducted at Semarang State University's FMIPA Undergraduate Study Program in Mathematics Education. The research subjects were Mathematics Education students of FMIPA Semarang State University who took the Introduction to Probability course in the even semester of the 2023/2024 academic year. The research subject selection technique used was purposive sampling technique (Sugiyono, 2013). The selection of subjects by considering the subject is in the low SAA group, can communicate their ideas clearly and based on the uniqueness of the answers given by students on probabilistic problem solving questions. The selection of subjects starts from the highest level and then the level below. The number of research subjects was 9 students.

Data collection methods include tests and interviews. The researcher serves as the main instrument in this study. Other instruments included a written test of probabilistic problem solving skills and interview guidelines. The interviews conducted were needed to obtain in-depth information and support what had been obtained from the written test. The interview guideline includes a list of questions the researcher asked the students who the research subjects during the interview were. Students' mistakes in answering probabilistic problems are supposed to be identified by these questions.

This study's data analysis employed the (Miles & Huberman, 1994) analytical technique, which consists of three steps: (1) data reduction; (2) data display; and (3) conclusion drawing/verification. Utilising triangulation procedures, such as comparing test results with interviews and evaluating each subject's work, data validity is checked.

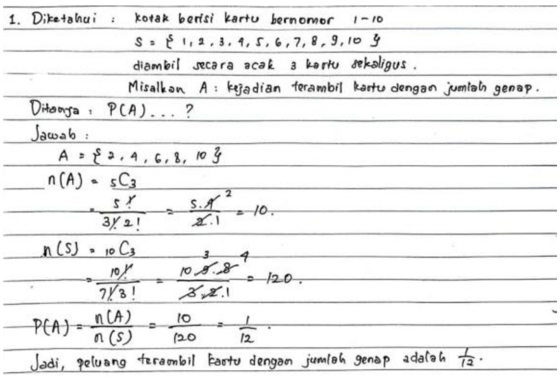
RESULT AND DISCUSSION

Results

Students were given a test consisting of three descriptive questions about the likelihood of events in order to identify the location and reasons for low SAA student errors in addressing probabilistic problems. The exam results were then trianguled with the interview results.

Analysis of Subject's Answer

Answer of Problem Number 1


1. Diketahui : kotak berisi kartu bernomor 1 – 10
S = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
diambil secara acak 3 kartu sekaligus.
Misalkan A : kejadian terambil kartu dengan jumlah genap.
Ditanya : P(A) . . . ?
Jawab :
A = {2, 4, 6, 8, 10}
n(A) = 5C3 = 5!/3!2! = 5.4/2.1 = 10.
n(S) = 10C3 = 10!/7!3! = 10.9.8/3.2.1 = 120.
P(A) = n(A)/n(S) = 10/120 = 1/12.
Jadi, peluang terambil kartu dengan jumlah genap adalah 1/12.

1. Given: A box contains cards numbered 1 to 10.
$S = \{1,2,3,4,5,6,7,8,9,10\}$.
3 cards are drawn randomly without replacement.
Let event **A** be: the event that all drawn cards have even numbers.
Question: $P(A)$?
Answer:
$A = \{2,4,6,8,10\}$.
$n(A) = C_3^5 = \frac{5!}{3!\times 2!} = \frac{5\times 4}{2\times 1} = 10.$
$n(S) = C_3^{10} = \frac{10!}{7!\times 3!} = \frac{10\times 9\times 8}{3\times 2\times 1} = 120.$
$P(A) = \frac{n(A)}{n(S)} = \frac{10}{120} = \frac{1}{12}.$
Therefore, the probability of drawing cards with even numbers is $\frac{1}{12}$.

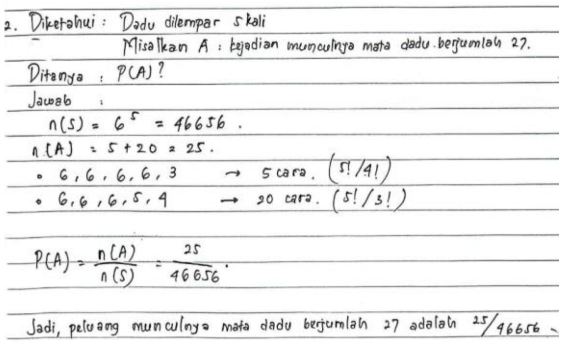
Figure 1. S-01's Answer on Problem Number 1

According to Newman's technique, which is shown in Table 1 below, the subject's written work can be classified as errors in probabilistic problem solving based on the results above.

Table 1. Analysis of S-01's Answer on Problem Number 1

Type of Error	Explanation
Reading	Cannot be investigated through work results.
Comprehension	S-01 can write the equation according to the problem presented. S-01 can write what is known and asked correctly.
Transformation	S-01 could not write down the formula to be used to solve the problem correctly.
Process skill	S-01 was unable to calculate the number of n(A) and n(S) correctly. S-01 was unable to calculate the probability correctly.
Encoding	S-01 could not write the conclusion of the problem correctly.

Answer of Problem Number 2


2. Diketahui : Dadu dilempar 5 kali
Misalkan A : kejadian munculnya mata dadu berjumlah 27.
Ditanya : P(A)?
Jawab :
n(S) = 6^5 = 46656.
n(A) = 5 + 20 = 25.
• 6, 6, 6, 6, 3 → 5 cara. (5!/4!)
• 6, 6, 6, 5, 4 → 20 cara. (5!/3!)
P(A) = n(A)/n(S) = 25/46656.
Jadi, peluang munculnya mata dadu berjumlah 27 adalah 25/46656.

2. Given: A die is rolled 5 times.
Let **A** be the event that the total sum of the dice is 27.
Question: $P(A)$?
Answer:
$n(S) = 6^5 = 46656$
$n(A) = 5 + 20 = 25$

- 6, 6, 6, 6, 3 → 5 ways $\left(\frac{5!}{4!}\right)$
- 6, 6, 6, 5, 4 → 20 ways $\left(\frac{5!}{3!}\right)$

$P(A) = \frac{n(A)}{n(S)} = \frac{25}{46656}$.
Therefore, the probability of getting a sum of 27 from the dice rolls is $\frac{25}{46656}$.

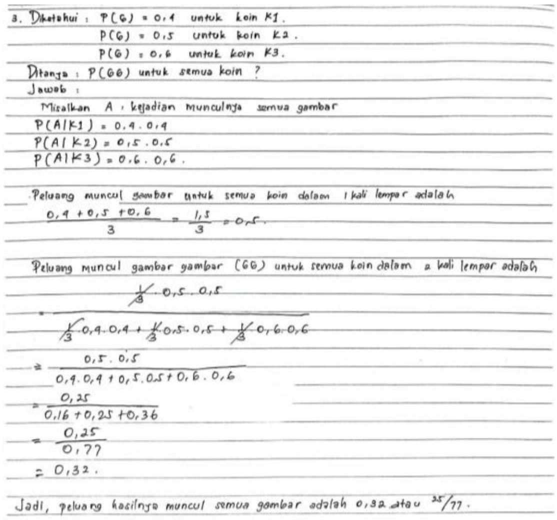
Figure 3. S-01's Answer on Problem Number 3

According to Newman's technique, which is shown in Table 2 below, the subject's written work can be classified as errors in probabilistic problem solving based on the results above.

Table 2. Analysis of S-01's Answer on Problem Number 2

Type of Error	Explanation
Reading	Cannot be investigated through work results.
Comprehension	S-01 can write the equation according to the problem presented. S-01 can write what is known and asked correctly.
Transformation	S-01 could not write down the formula to be used to solve the problem correctly.
Process skill	S-01 was unable to calculate the number of n(A) and n(S) correctly. S-01 was unable to calculate the probability correctly.
Encoding	S-01 could not write the conclusion of the problem correctly.

Answer of Problem Number 3


3. Diketahui : P(G) = 0,4 untuk koin K1.
P(G) = 0,5 untuk koin K2.
P(G) = 0,6 untuk koin K3.
Ditanya : P(GG) untuk semua koin ?
Jawab :
Misalkan A : kejadian munculnya semua gambar
P(A|K1) = 0,4 . 0,4
P(A|K2) = 0,5 . 0,5
P(A|K3) = 0,6 . 0,6.
Peluang muncul gambar untuk semua koin dalam 1 kali lempar adalah
(0,4 + 0,5 + 0,6)/3 = 1,5/3 = 0,5.
Peluang muncul gambar gambar (GG) untuk semua koin dalam 2 kali lempar adalah
= (1/3 . 0,5 . 0,5) / (1/3 0,4 . 0,4 + 1/3 0,5 . 0,5 + 1/3 0,6 . 0,6)
= (0,5 . 0,5) / (0,4 . 0,4 + 0,5 . 0,5 + 0,6 . 0,6)
= 0,25 / (0,16 + 0,25 + 0,36)
= 0,25 / 0,77
= 0,32.
Jadi, peluang hasilnya muncul semua gambar adalah 0,32 atau 25/77.

3. **Given:**

- $P(H) = 0{,}4$ for coin K1
- $P(H) = 0{,}5$ for coin K2
- $P(H) = 0{,}6$ for coin K3

Question: What is $P(HH)$ for all coins?
Answer:
Let A be the event that all coins show heads.

- $P(A|K1) = 0{,}4 \times 0{,}4$
- $P(A|K2) = 0{,}5 \times 0{,}5$
- $P(A|K3) = 0{,}6 \times 0{,}6$

The probability of getting heads for each coin in a single toss is:
$\frac{0{,}4+0{,}5+0{,}6}{3} = \frac{1{,}5}{3} = 0{,}5$.
Probability of getting heads on all coins (HH) in double toss is:

$$P(HH) = \frac{\frac{1}{3}\times 0{,}5\times 0{,}5}{\left(\frac{1}{3}\times 0{,}4\times 0{,}4\right)+\left(\frac{1}{3}\times 0{,}5\times 0{,}5\right)+\left(\frac{1}{3}\times 0{,}6\times 0{,}6\right)}$$
$$= \frac{0{,}5\times 0{,}5}{(0{,}4\times 0{,}4)+(0{,}5\times 0{,}5)+(0{,}6\times 0{,}6)}$$
$$= \frac{0{,}25}{0{,}16+0{,}25+0{,}36}$$
$$= \frac{0{,}25}{0{,}77}$$
$$= 0{,}32.$$

Therefore, the probability of all coins showing heads is $\mathbf{0,32}$ **or** $\frac{25}{77}$.

Figure 2. S-01's Answer on Problem Number 2

According to Newman's technique, which is shown in Table 3 below, the subject's written work can be classified as errors in probabilistic problem solving based on the results above.

Table 3. Analysis of S-01's Answer on Problem Number 3

Type of Error	Explanation
Reading	Cannot be investigated through work results.
Comprehension	S-01 can write the equation

	according to the problem presented. S-01 can write what is known and asked correctly.
Transformation	S-01 could not write down the formula to be used to solve the problem correctly.
Process skill	S-01 was unable to calculate the odds correctly.
Encoding	S-01 could not write the conclusion of the problem correctly.

Interview Results of Subject

Interview Related to Reading Step

Table 4. Interview Excerpt of S-01 in Reading Step

Revealing causes of error for reading error types		
No	**Question (Researcher)**	**Student Answer (Subject)**
1	Read the question!	(Subject reads the problem)
2	Do you know the meaning of each word in the question?	Yes, it is clear.
3	Do you know the keywords written in the problem so that you can work on the problem?	The first keyword is that there is a box containing numbers 1-10 and then the probability of an even number of cards being drawn is determined.

Interview Related to Comprehension Step

Table 5. Interview Excerpt of S-01 in Comprehension Step

Revealing causes of error for comprehension error		
No	**Question (Researcher)**	**Student Answer (Subject)**
1	Can you explain or mention what is known from the question?	The known sample space is 1-10, I suppose A is the event that an even number of cards are drawn.
2	Can you explain or state what the question is?	Asked about the probability of drawing an even number of cards

Interview Related to Transformation Step

Table 6. Interview Excerpt of S-01 in Transformation Step

Revealing causes of error for transformation error		
No	**Question (Researcher)**	**Student Answer (Subject)**
1	Tell me in general terms how you would find the answer to the problem?	First, I wrote the known with a sample space of 1-10 and then randomly picked 3 at a time, I assumed A was the event that an even number of cards were drawn. Then here I answer that A is the sample space of event A. I thought when I was working on the card with an even number. The even number is 5 and then 3 are drawn so 5C3
2	Can you explain what formula you used to solve the problem?	(Subject looks confused)

Interview Related to Process Skill Step

Table 7. Interview Excerpt of S-01 in Process Skill Step

Revealing causes of error for process skill error		
No	**Question (Researcher)**	**Student Answer (Subject)**
1	Does the final result of your calculation answer the problem?	No
2	If not, what other steps should you take to find what is being asked?	I suppose A is the occurrence of cards with an even number while what is asked is the number of cards with an even number should be taking card 1 + card 2 + card 3 with an even number. If the

		number is even, I should have made several possibilities, for example, the first event is taking card 1, such as 1 taking card 2, 3 then 4 so that the result is even.

Interview Related to Encoding Step

Table 8. Interview Excerpt of S-01 in Encoding Step

Revealing causes of error for Encoding Error		
No	**Question (Researcher)**	**Student Answer (Subject)**
1	Does the conclusion answer the problem?	No

Triangulation of Test and Interview Results

Triangulation of Problem Number 1

Based on the results of S-01's written test and interview, it was concluded that S-01 made mistakes at the transformation stage. Because S-01 was unable to write down the formula that would be utilised to solve the problem accurately, an error occurred during the transformation stage. Additionally, because to his inability to accurately calculate the number of n(A) and n(S), S-01 also made mistakes at the process skill stage. S-01 made a mistake in the encoding stage because he was unable to write the problem's conclusion appropriately due to the process skill stage fault. Problems that are implicit in nature make many students unable to solve problems because of difficulties in understanding the problem being asked (Pongsakdi et al., 2020). Based on some of these things, S-01 is less capable in solving probablistic problems according to Newman's procedure.

Triangulation of Problem Number 2

According to the findings of S-01's written exam and interview, S-01 erred during the transformation phase. At the transformation stage, S-01 made a mistake since it was unable to create the formula that would be utilised to solve the problem accurately. Additionally, S-01 incorrectly calculated the number of n(A) and the probability, which led to errors at the process skill stage. Due of his inability to write the problem's conclusion correctly, S-01 committed a mistake at the encoding step as a result of the process skill stage error. Students' difficulty in understanding the problem makes students unable to determine the calculation steps to be used, so that it has an impact on the results obtained (Subekti & Sari, 2021). Based on some of these things, S-01 is less capable in solving probabilistic problems according to Newman's procedure.

Triangulation of Problem Number 3

According to the findings of S-01's written exam and interview, S-01 erred during the transformation phase. The error made at the transformation stage was because S-01 could not write the formula that would be used to solve the problem correctly. Furthermore, S-01 also made mistakes at the process skill stage because he was unable to calculate the probability correctly. Due to The error at the process skills stage, S-01 also made an error at the encoding stage because he was unable to write the problem's conclusion correctly. Based on some of these things, S-01 is less capable in solving probabilistic problems according to Newman's procedure.

Triangulation Results

Based on the findings of the written exam and interview, it was determined that S-

01 erred on questions 1, 2, and 3. S-01's errors happened during the encoding, process skills, and transformation phases. The transformation error occurred as a result of S-01's process skills fault, as they failed to write down the formula that would be utilised to solve the problem appropriately. Meanwhile, the calculating procedure was not done carefully by S-01, which resulted in the process skill error. Because of this, S-01 was unable to properly construct the conclusion, which resulted in mistakes during the encoding process as well. Table 9 below provides a summary of the mistakes S-01 made when completing the probablistic problem solving abilities exam using Newman's methodology.

Table 9. Subject S-01's Errors

Type of Error	Problem		
	1	2	3
Reading	-	-	-
Comprehension	-	-	-
Transformation	*	*	*
Process skill	*	*	*
Encoding	*	*	*

Description:
- : No error
* : Made a mistake

Furthermore, based on the test and interview results of the nine Subjects S-01, S-02, S-03, S-04, S-05, S-06, S-07, S-08, and S-09, the location of low SAA students' errors in probabilistic problem solving is presented in Table 10 below.

Table 10. Tendency of Low SAA Students' Error Types in Probabilistic Problem Solving

Subjek	Error Accumulation					Type of Error
	R	C	T	P	E	
S-01	0	0	1	2	1	*Transformation*, *Process Skill*, and *Encoding*
S-02	0	0	1	2	1	*Transformation*, *Process Skill*, and *Encoding*
S-03	0	0	1	2	1	*Transformation*, *Process Skill*, and *Encoding*
S-04	0	0	1	2	1	*Transformation*, *Process Skill*, and *Encoding*
S-05	0	0	1	2	1	*Transformation*, *Process Skill*, and *Encoding*
S-06	0	0	1	2	1	*Transformation*, *Process Skill*, and *Encoding*
S-07	0	0	1	2	1	*Transformation*, *Process Skill*, and *Encoding*
S-08	0	0	1	2	1	*Transformation*, *Process Skill*, and *Encoding*
S-09	0	0	1	2	1	*Transformation*, *Process Skill*, and *Encoding*

Description: R: Reading; C: Comprehension; T: Transformation; P: Process Skill; and E: Encoding

Complete data for other subjects can be accessed here.

Discussion

According to the results of the triangulation of tests and interviews, as well as the testing of subjects 1 through 9, students with low SAA in probabilistic problem solving commonly make mistakes in the transformation stage, the calculation process (process skill), and the writing of answers (encoding). Students with low SAA have been able to solve problems correctly during the reading and comprehension stages. Errors made by students can be in the form of systematic or incidental errors. students with systematic errors mean that the level of mastery of the material is not optimal, while students with incidental errors are not caused by the level of mastery of the material but due to other factors such as carelessness and lack of accuracy (Dj Pomalato et al., 2020). At the transformation stage in problem solving becomes an essential strategy because it changes the representation at the next stage (Milinković, 2022). So, it is important for students not to make mistakes at that stage. According to the interview results, students' inability to understand the necessary procedures for tackling probabilistic problems is the main reason why they make mistakes while approaching them. This has an impact on the final solution that is not appropriate.

From the results of the interview it was also found that students just guessed the strategy used. Students are sometimes still confused between the use of permutations and combinations, still confused in determining the sample space between taking 1 object and several objects in the experiment. Also students are still confused in determining the number of sample points in the event in question. They have not been able to determine when to use the rules of multiplication, permutation and combination. Additionally, students are still unable to comprehend the meaning of the provided challenge. For example, the meaning of the appearance of 27 dice in rolling the dice 5 times, they only think the number 27 is impossible, because the largest dice is 6, or they also think the number 27 can only occur with the composition of the first throwing appears 6, the second throwing appears 6, The third throwing appears 6, the fourth throwing appears 6, the fifth throwing appears 3, even though there are still other possibilities for the composition of the appearance of 27 dice, such as the composition of the first throwing appears 6, the second throwing appears 6, the third throwing appears 6, the fourth throwing appears 5, the fifth throwing appears 4. From the interview results, it was found that students mostly memorized the problem solving that had been given. Students find it difficult to solve problems especially in probability because the understanding related to basic concepts is not strong, so that advanced topics learned cannot be absorbed easily and rely on examples and limited understanding (Alenezi, 2020). This can be seen from the answers of students who use strategies like the example problems given, even though the problems given are different from the examples, they are fooled by the context of the same problem, but different questions.

The constraints of low SAA students at the strategy planning stage are also supported by Agoestanto et al. (2024) which states that subjects with low SAA have not been able to fully write a problem solving plan and cannot choose the right problem solving strategy. Mathematical problem solving is one of the abilities that require cognitive processes. Purnomo et al. (2022) at in his research found that students with low ability were only able to do a little cognitive process. Shoi Using the proper problem-solving approach is one of the crucial steps in problem-solving; faults in the strategy lead to errors in solving and interpreting the outcomes of the solutions gained. Subjects with low SAA turned out to have errors in compiling mathematical models and strategies to be used which resulted in the subject also being unable to use problem-solving strategies which ultimately were also wrong in interpreting the results of the answers obtained. This is in accordance with the study by Cai et al. (2019), which found that most students do not clearly understand the basic concepts of probability they have learned.

Students make mistakes when deciding on the next approach because they lack sufficient attention when selecting the addition or multiplication rules, and they are still unsure of when to use each rule. Conceptually it is simple, but once dealing with new problems students have not been able to apply the right rules so as to produce incorrect odds values. The difficulty in determining this opportunity is also in line with Shodiqin et al. (2021) which reports that there is still a lack of understanding of student concepts related to opportunity material, students also cannot determine the opportunities and formulas used appropriately, causing errors in solving problems.

Students' limitations when choosing techniques cause them to implement improper strategies, which produces weak problem-solving outcomes. Strategies in problem solving are very important because when the strategy has been applied, it means that students understand the problem to be solved so as to minimize the mistakes that will be made (Szabo et al., 2020). On the other hand, choosing a strategy is a crucial part of the problem-solving procedure. According Yayuk & Husamah (2020), deciding on a strategy is a crucial step in problem-solving.

Implication of Research

Low SAA students need to be given the task of practicing probability problem solving gradually starting from problems with low, medium and high difficulty levels. If necessary, there are brief instructions in developing a solution strategy.

Limitation

The limitations of the study include only taking 9 low SAA subjects from one class so that the characteristics of the subjects still do not represent the characteristics of students in one study program. The interview could not be conducted on one day, so it is possible that there are subjects who already know what will be asked during the interview.

CONCLUSION

In the process of addressing probabilistic problems, students with low SAA made errors in the transformation, process skill, and encoding processes. Students' errors are caused by their ignorance of the methods required to solve probabilistic problems. Because of this, the subject was unable to appropriately solve the probabilistic problem.

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