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Exploring Creative Thinking in Solving Open-Ended Statistical Problems: A Descriptive Study of Grade 12 Learners at SMA Negeri 14 Jambi

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ABSTRACT

This study examines the creative thinking of Grade 12 students in solving open-ended statistical problems. The research addresses the problem of limited understanding of how students with different mathematical ability levels demonstrate creative thinking when working with open-ended statistical tasks, and aims to describe the fluency, flexibility, originality, and elaboration reflected in their solutions. Three students representing high, medium, and low achievement levels were selected through purposive sampling to capture varied mathematical abilities. Data were collected through written tests and interviews, and analyzed using indicators of fluency, flexibility, originality, and elaboration. An exploratory, qualitative approach was employed to gain in-depth insights into students' reasoning processes. Results show that the high-achieving student generated two valid datasets (mean = 25, median = 23, mode = 20), the medium-achieving student produced one nearly accurate dataset (mean = 24.9), and the low-achieving student produced a dataset with a mean of 23.5. For the second problem, all students obtained b = 12, but only the high-achieving student justified why it is the minimum. In the third problem, all calculated the average yield as 1.225 tons, yet only the high-achieving student provided a contextual interpretation. These findings indicate that open-ended tasks reveal clear differences in students' creative thinking. The results suggest that incorporating open-ended problems into statistics lessons can enhance students' creative mathematical reasoning and support the development of higher-order thinking.

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1. INTRODUCTION

Twenty-first-century education demands that students master higher-order thinking skills, one of which is creative thinking. The PISA framework emphasizes that creative thinking is an essential competence that enables students to generate original and effective ideas for solving real-world problems [1]. Creativity in education also involves students' willingness to take intellectual risks, express new ideas, and develop unconventional solutions [2]. Therefore, schools play a crucial role in providing challenging learning environments that allow students to practice and develop their creative thinking skills.

In the context of mathematics learning, creative thinking is closely tied to problem-solving. Problem posing, especially through open-ended problems, is a key strategy for fostering mathematical creativity, as it allows students to generate diverse strategies and express their original ideas [3]. Open-ended problems also encourage flexibility in thinking and enable students to connect multiple mathematical concepts within a single problem [4]. Hence, open-ended tasks are widely recognized as effective tools for promoting students' creative mathematical processes.

Recent studies have shown that open-ended problems enhance students' fluency, flexibility, originality, and elaboration in generating ideas. For instance, integrating the history of mathematics into open-ended problems encourages students to produce multiple strategies and creative solutions [5]. Likewise, group discussions in open-ended geometry tasks motivate students to express novel ideas and elaborate their reasoning more deeply [6]. Other studies have demonstrated that open-ended tasks prompt students to shift between multiple representations and construct unique solution paths, which directly supports creative mathematical thinking [4]. Furthermore, research has found that students working with tasks that allow more than one correct answer tend to generate higher-quality explanations and display greater strategic variety, indicating enhanced creative performance [7]. These findings suggest that open-ended problems not only assess procedural skills but also facilitate the development of students' creative thinking processes.

In statistics, open-ended problems are highly relevant since the topic involves real-world data that can be interpreted from various perspectives. Learning statistics through open-ended case studies helps students strengthen both inferential reasoning and creativity in designing and evaluating solutions [8]. Similarly, students' mathematical creativity can be stimulated when they are allowed to construct their own datasets, interpret graphs, and draw conclusions from the same data using different approaches [9]. Therefore, statistics serves as a promising domain to explore students' creative thinking through open-ended problems.

Beyond creative thinking, another relevant cognitive aspect is the ability to think reversibly. Research has shown that reversible thinking can be developed through metacognitive approaches, particularly by providing problems that require students to trace processes backward from the result to the initial condition [10]. Similarly, students trained in reversible thinking during geometry problem solving were found to be more capable of identifying alternative solution paths rather than sticking to one fixed procedure [11]. Although reversible thinking is evident in certain statistical tasks and shares conceptual overlaps with creative thinking, particularly in aspects of flexibility and generating multiple possibilities, it is not the primary construct examined in this study. Prior research indicates that reversible thinking can support fluency and flexible reasoning because it allows students to reinterpret information and consider problems from different directions

[12,13]. Therefore, in this study, reversible thinking is included only as a supporting cognitive process, rather than as a variable analyzed in the findings.

The relationship between creative and reversible thinking becomes evident when students engage with statistical problems. For example, given measures of central tendency, students may be asked to reconstruct possible raw datasets. Such activities stimulate fluency in generating many possibilities, flexibility in shifting strategies, and originality in creating unique data combinations [14]. Similar findings were reported in studies showing that backward reasoning tasks encourage students to analyze information from different perspectives and creatively reorganize numerical relationships [15]. Reversible thinking is also described as a process that supports the construction of multiple solution paths, which is an important aspect of creative problem solving in mathematics [14]. In this sense, reversible thinking within statistics serves as a gateway to understanding how students' mathematical creativity operates.

However, despite the growing interest in mathematical creativity and reversible thinking, studies that specifically connect these aspects to open-ended problem-solving in statistics at the senior high school level remain scarce. Most prior research has focused on algebra or geometry [10,11], while statistics has rarely been explored. In particular, studies show that statistics in senior secondary schools is often taught procedurally and assessed through routine computations, leaving little room for creative exploration [8]. Research examining how learners construct datasets, justify interpretations, or generate multiple statistical solutions is limited, indicating a significant empirical gap at the high school level [9]. Nevertheless, the contextual nature of statistics provides fertile ground for the emergence of diverse and creative solutions. Thus, a clearer research gap emerges: creative thinking in open-ended statistics problems at the senior secondary level is still underexplored and requires systematic investigation.

SMA Negeri 14 Kota Jambi was selected as the research site because of its diverse student characteristics in terms of academic ability and socio-cultural background. The school has implemented the Merdeka Curriculum, which emphasizes competency-based learning and the development of higher-order thinking. In mathematics instruction, teachers have begun introducing concept-based tasks; however, the explicit use of open-ended problems remains limited. This makes SMA Negeri 14 Kota Jambi an ideal setting to explore how students respond to and exhibit creative thinking when working on open-ended statistical problems.

Based on the issues identified above, the research problem in this study concerns the limited understanding of how students with different mathematical ability levels demonstrate creative thinking when solving open-ended statistical problems. To address this issue, the researcher analyzes students' reasoning processes using indicators of fluency, flexibility, originality, and elaboration as a framework for interpreting their creative thinking.

Based on this rationale, the present study aims to explore students' creative thinking abilities in solving open-ended problems on statistical topics. The main focus is to describe the indicators of creative thinking, namely fluency, flexibility, originality, and elaboration, that emerge in students' responses, as well as to identify the problem-solving strategies they employ.

The theoretical contribution expected from this study is to enrich existing literature by providing empirical evidence on creative thinking in statistics, a topic that remains underexplored compared to algebra and geometry. Practically, the findings are expected to support teachers in designing learning activities that effectively stimulate students' creative reasoning, especially within the context of the Merdeka Curriculum.

Accordingly, this study is guided by two research questions:

1) How do high-, medium-, and low-achieving students demonstrate creative thinking indicators when solving open-ended statistical problems?
2) What types of reasoning or strategies appear in their solutions?

2. METHOD

This study employed an exploratory qualitative approach aimed at describing students' creative thinking abilities in solving open-ended problems related to statistical topics. This approach was chosen because qualitative research allows the researcher to gain a deeper understanding of students' thought processes rather than focusing solely on their final answers [16]. The study was conducted at SMA Negeri 14 Kota Jambi, with participants selected using purposive sampling based on recommendations from the mathematics teacher, who identified the class as having diverse academic abilities. This sampling technique was considered appropriate because it enables the collection of rich and relevant information from selected participants [17].

The research instruments consisted of three components. First, a written test containing three open-ended statistical problems was designed to elicit various problem-solving strategies. Second, an observation sheet is used to record indicators of students' creative thinking during the problem-solving process. Third, a semi-structured interview guide was developed to explore students' reasoning behind their choice of particular strategies. The creative thinking indicators were adapted from the PISA framework [1] and supported by theoretical perspectives, which include fluency (the ability to generate multiple ideas), flexibility (the ability to use diverse strategies), originality (the ability to produce unique solutions), and elaboration (the ability to explain solutions in detail) [14].

To clarify these indicators, Table 1 presents a summary of the creative mathematical thinking components used in this study.

Table 1. Indicators of Mathematical Creative Thinking Ability

No	Indicator	Brief Description
1	Fluency	Generating many ideas or alternative answers
2	Flexibility	Using diverse strategies or approaches
3	Originality	Producing unique or uncommon solutions
4	Elaboration	Explaining solutions in a detailed, logical, and coherent way

Data were collected through three techniques: written tests, observation, and interviews. The results of these three methods were triangulated to enhance the credibility of the data [18]. Data analysis consisted of three stages: data reduction, data display, and conclusion. Students' written responses were analyzed to identify the emergence of creative thinking indicators, while the results of observations and interviews were used to support and strengthen the interpretation.

Ethical considerations were applied throughout the research process. Participation was voluntary, and all students received a clear explanation of the purpose, procedures, and use of the data before agreeing to participate. Written informed consent was obtained from both the students and the mathematics teacher, in accordance with recommendations for ethical qualitative research [19]. To ensure confidentiality, pseudonyms such as S1, S2, and S3 were used, and all documents and recordings were stored securely and used only for research purposes in accordance with standard ethical guidelines [18].

A coding procedure was used to analyze qualitative data systematically. Open coding was conducted to identify statements related to fluency, flexibility, originality, and elaboration, following common procedures in qualitative analysis [20]. Axial coding was then used to group similar codes into broader categories representing students' reasoning patterns. Finally, selective coding was applied to integrate the categories and construct a comprehensive description of each student's creative thinking profile. The coding results were validated through triangulation across written responses, interviews, and observations, which aligns with established qualitative research credibility techniques [18].

3. RESULTS AND DISCUSSION

This study aimed to explore how students with varying levels of mathematical ability demonstrated creative thinking processes in solving open-ended problems related to statistical topics. Three participants were selected to represent different levels of mathematical thinking ability, namely S1 (high), S2 (medium), and S3 (low). Three participants were selected to represent high, medium, and low levels of mathematical thinking, as purposive sampling enables the researcher to choose individuals who can provide rich and relevant information for an in-depth qualitative analysis [21].

The research instrument consisted of three open-ended problems on statistics designed to stimulate the emergence of students' creative thinking abilities. These problems were adapted from instruments used in previous studies [22] that had undergone expert validation and pilot testing with senior high school students. Adjustments were made to the context, wording, and difficulty level to ensure alignment with the characteristics of Grade 12 students at SMA Negeri 14 Kota Jambi.

Open-ended problems were chosen because they provide opportunities for students to demonstrate a variety of strategies and reasoning approaches, allowing their creative thinking skills to be explored in greater depth. Each problem was constructed to encourage students to exhibit aspects of fluency (the ability to generate many ideas), flexibility (the ability to use multiple strategies), originality (the ability to produce unique ideas), and elaboration (the ability to explain reasoning in detail). These indicators were adapted from Torrance's framework (1974) and reinforced by the creative thinking framework developed by the OECD (2022).

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Table 2. Open-Ended Questions in Statistics Topic

<table>
<tr><th>No</th><th>Questions</th></tr>
<tr><td>1</td><td>Buatlah beberapa kumpulan data yang terdiri atas 7 nilai dan memiliki mean = 25, median = 23, dan modus = 20. Jelaskan bagaimana kamu menentukan data tersebut dan mengapa data yang kamu buat memenuhi syarat!</td></tr>
<tr><td>2</td><td>Rini menanam b biji cabai di kebun sekolah. Pada hari ke-20, 4 tanaman memiliki tinggi 96 cm, tanaman lainnya memiliki tinggi minimal 66 cm, dan rata-rata tinggi semua tanaman adalah 76 cm. Berapakah nilai b terkecil yang mungkin? Jelaskan!</td></tr>
<tr><td>3</td><td>Pak Rahman ingin mengikuti program pelatihan dengan syarat rata-rata hasil panen minimal 1,5 ton selama delapan periode terakhir.
<table>
<tr><td>Periode Panen</td><td>Hasil (kg)</td></tr>
<tr><td>Juli 2021</td><td>950</td></tr>
<tr><td>Nov 2021</td><td>700</td></tr>
<tr><td>Mar 2022</td><td>1.150</td></tr>
<tr><td>Juli 2022</td><td>1.900</td></tr>
<tr><td>Nov 2022</td><td>1.050</td></tr>
<tr><td>Mar 2023</td><td>1.500</td></tr>
<tr><td>Juli 2023</td><td>850</td></tr>
<tr><td>Nov 2023</td><td>1.700</td></tr>
</table>
Berdasarkan data hasil panen berikut, apakah Pak Rahman memenuhi syarat tersebut? Jelaskan dengan sebanyak mungkin cara yang kamu ketahui.</td></tr>
</table>

3.1. Results

Problem 1: Constructing Data with Given Mean, Median, and Mode

The first problem required students to construct a dataset that meets three statistical conditions: mean, median, and mode. This task was open-ended because it allowed multiple possible solutions. Thus, students were not merely applying formulas but were encouraged to think divergently and explore the relationships among mean, median, and mode.

S1 (high-achieving student) created two different data sets: (1) 20, 20, 21, 23, 27, 30, 34, and (2) 19, 20, 20, 23, 29, 30, 32. Both sets satisfied the three conditions: mean = 25, median = 23, and mode = 20. S1 explained that they placed the median (23) at the center and then adjusted the remaining values so that the total produced a mean of 25. The student also justified the reasoning by explaining that the extreme values must be balanced to maintain the mean without changing the median or mode.

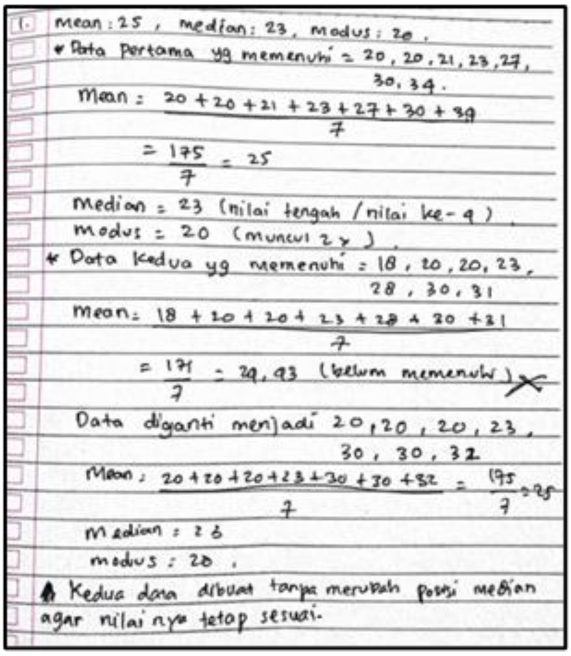
1. Mean : 25 , median : 23 , modus : 20 .
* Data pertama yg memenuhi = 20 , 20 , 21 , 23 , 27 , 30 , 34 .
Mean : (20 + 20 + 21 + 23 + 27 + 30 + 34) / 7
= 175 / 7 = 25
Median = 23 (nilai tengah / nilai ke-4) .
modus = 20 (muncul 2 x) .
* Data kedua yg memenuhi = 18 , 20 , 20 , 23 , 28 , 30 , 31
mean : (18 + 20 + 20 + 23 + 28 + 30 + 31) / 7
= 171 / 7 = 24,43 (belum memenuhi) ✗
Data diganti menjadi 20 , 20 , 20 , 23 , 30 , 30 , 32
Mean : (20 + 20 + 20 + 23 + 30 + 30 + 32) / 7 = 175 / 7 = 25
Median : 23
modus : 20 .
* Kedua data dibuat tanpa merubah posisi median agar nilai nya tetap sesuai.

Figure 1. S1’s Response for Problem 1

S1 demonstrated high creative thinking across all four indicators. They produced multiple alternatives (fluency), adjusted data values according to the given conditions (flexibility), and generated unique datasets rather than relying on conventional patterns (originality). Their reasoning was detailed and conceptually sound (elaboration). S1’s thought process reflected metacognitive awareness, showing not only computational understanding but also reflection on how statistical measures interact within the dataset.

S2 (a medium-achieving student) produced one dataset: 20, 20, 22, 23, 26, 28, 35, which resulted in a mean of 24.9, a median of 23, and a mode of 20. The student noted that the result was “almost 25” but did not attempt to revise it. In the written explanation, S2 identified that the median was the middle value, and the mode was the most frequently occurring number.

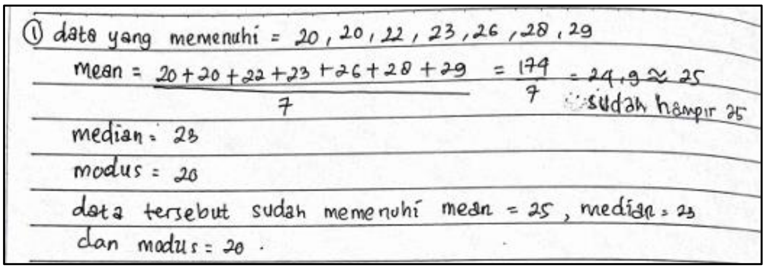
① data yang memenuhi = 20 , 20 , 22 , 23 , 26 , 28 , 29
Mean = (20 + 20 + 22 + 23 + 26 + 28 + 29) / 7 = 174 / 7 = 24,9 ≈ 25
∴ sudah hampir 25
median = 23
modus = 20
data tersebut sudah memenuhi mean = 25 , median = 23
dan modus = 20 .

Figure 2. S2’s Response for Problem 1

S2 demonstrated a sufficient understanding of basic concepts. They correctly identified the median and mode, but did not refine the dataset when the mean was inaccurate. This demonstrates limited fluency, as only one alternative was produced, and weak flexibility, as no attempt was made to adjust the values. However, some elaboration was observed as the student explained the procedural steps, though without deeper reflection.

S3 (low-achieving student) wrote the data 20, 20, 21, 23, 25, 27, 29. The calculated mean was 23.5, the median was 23, and the mode was 20. The student noted that the median and mode were correct but that the mean was not 25, with no attempt to make adjustments.

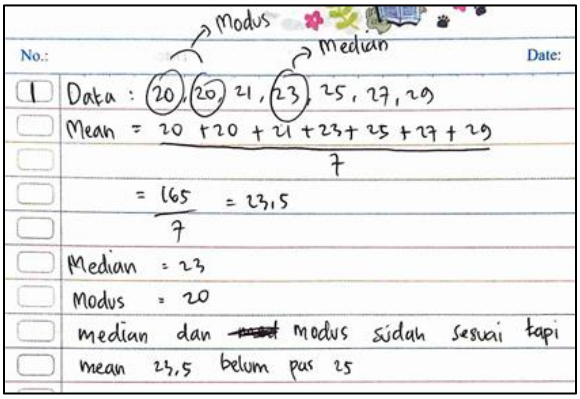

Figure 3. S3's Response for Problem 1

S3 correctly understood the concepts of median and mode but failed to relate them to the mean. The reasoning remained linear and procedural, showing minimal flexibility or originality. This suggests that the student is in the early stages of developing creative thinking, particularly in adapting and modifying ideas.

Problem 2: Determining the Number of Chili Plants

The second problem required students to determine the number of plants based on the given average height and minimum plant height. This problem encouraged reversible thinking, as students needed to reason backward from the result to the initial conditions.

S1 began by clearly writing the "Given" and "Asked" parts before attempting to solve the problem. They noted: four plants were 96 cm tall, the mean height was 76 cm, and the minimum height was 66 cm. Using an algebraic method, S1 determined the total number of plants and verified the result. The student added a justification that if the other plants were taller than 66 cm, the total number would increase.

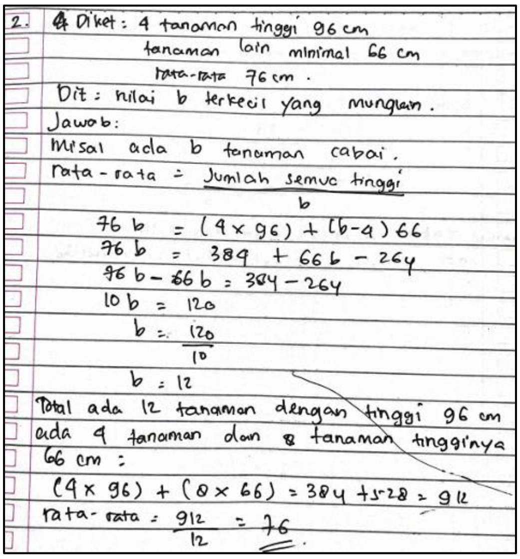

Figure 4. S1's Response for Problem 2

S1 demonstrated logical and reflective reasoning. They employed a formal approach while demonstrating an awareness of the reverse-thinking process. The student not only presented the final answer but also discussed how changes in data could affect the result. This reflected strong flexibility and elaboration, as well as metacognitive reflection linking the concept of mean to real data.

S2 used the same formula and obtained b = 12, but did not write the “Given” and “Asked” sections. Although the solution was correct, no justification was provided for why this was the smallest possible number.

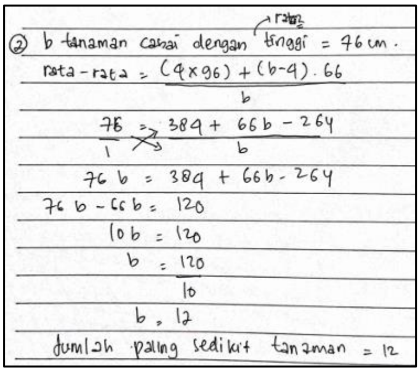

Figure 5. S2’s Response for Problem 2

S2 understood the relationship among the mean, total value, and data elements, but their reasoning remained algorithmic. The process lacked exploration or reverse reasoning. Elaboration was visible in the computation steps, but originality and flexibility were low.

S3 applied a trial-and-error approach, repeatedly guessing the number of plants and recalculating the mean each time. The student eventually arrived at b = 12, but the work contained numerous corrections and revisions, indicating uncertainty.

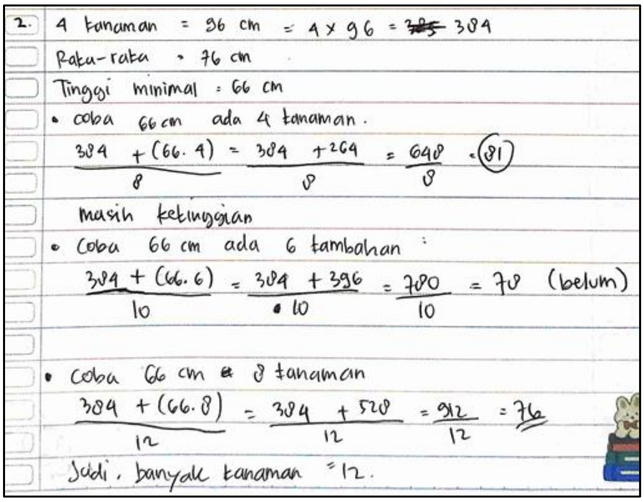

Figure 6. S3’s Response for Problem 2

Although inefficient, S3’s approach showed some exploratory thinking through repeated trials. This reflects emerging fluency, but with limited elaboration and conceptual understanding. The strategy was intuitive rather than conceptual, yet it still indicated an initial form of creative exploration.

Problem 3: Assessing Eligibility Based on Average Yield

The third problem asked students to calculate the average rice yield and interpret its meaning in a real-life context. This problem allowed students to display divergent thinking through various forms of data representation (numerical, verbal, or visual).

S1 wrote the “Given” and “Asked” parts before starting. The student summed the total yield from eight periods, divided it by the number of periods, and found a mean of 1.225 tons. This result was then compared with the minimum requirement of 1.5 tons. S1 concluded that the yield did not meet the criterion, falling short by 0.275 tons. Interestingly, S1 added an interpretive explanation, stating that the 0.275-ton difference represents the amount by which the average must increase to qualify for the training program.

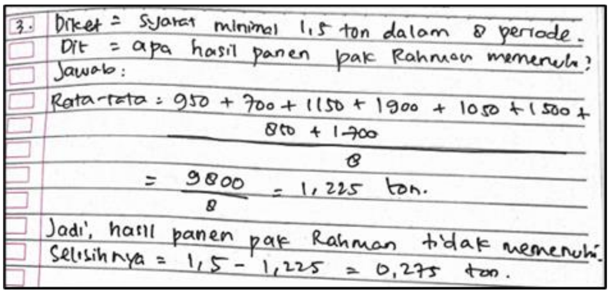

Figure 7. S1’s Response for Problem 3

S1 demonstrated high fluency and elaboration, presenting clear reasoning and extending the analysis beyond the calculation. Although no visual representation was provided, the student exhibited originality by contextualizing the mathematical result within a real-world scenario.

S2 correctly calculated the average yield of 1.225 tons and wrote a concise conclusion that the yield “does not meet the requirement because it is less than 1.5 tons.”

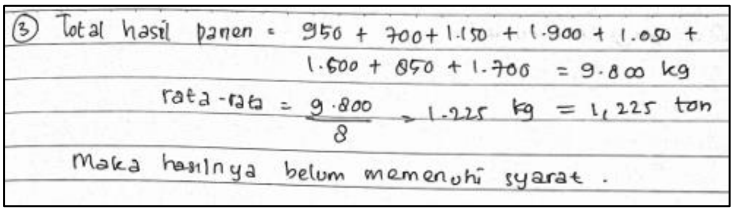

Figure 8. S2’s Response for Problem 3

S2 understood the calculation and context but did not expand the reasoning or offer alternative representations. Their reasoning was linear, showing moderate elaboration but low originality.

S3 also calculated the total yield and obtained 1.225 tons, but concluded only that it “does not meet the requirement.”

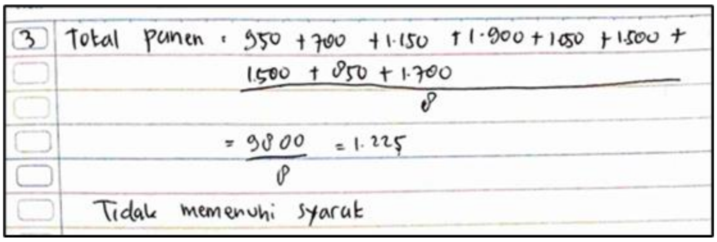

Figure 9. S3's Response for Problem 3

S3 showed minimal procedural understanding. The student could apply the basic mean formula, but failed to reflect or consider alternative perspectives. There was no evidence of originality or elaboration in the response.

3.2. Discussion

The exploration results revealed clear differences in students' creative thinking abilities when solving open-ended problems in statistics. The high-achieving student (S1) demonstrated structured, flexible, and reflective thinking processes, while the medium-achieving student (S2) tended to focus on standard procedures. Meanwhile, the low-achieving student (S3) showed limitations in generating new ideas and explaining their reasoning in detail. These variations indicate that mathematical creative thinking is not solely reflected in obtaining correct answers, but also in how students connect, modify, and present their ideas throughout the problem-solving process [1,23]

S1 demonstrated strong creative thinking skills through fluency and flexibility in selecting problem-solving strategies. The student also demonstrated good elaboration by contextualizing the results, such as interpreting the 0.275-ton difference as the additional yield needed to meet the training requirement. This finding aligns with the PISA framework, which emphasizes that creative thinking in mathematics involves the ability to generate multiple ideas, adapt approaches to context, and provide meaningful explanations of outcomes [1]. S1's performance also reflects the characteristics of mathematical creativity, namely the capacity to identify conceptual relationships and develop new ideas relevant to the situation at hand [23]. In terms of Torrance's indicators, S1 demonstrated high fluency by generating multiple valid responses, strong flexibility through the use of varied strategies, originality in constructing non-standard datasets, and elaboration by providing clear justification for each solution.

In contrast, S2 exhibited limited fluency and failed to demonstrate flexibility in strategy use. Although S2 could perform correct calculations, their reasoning process was procedural and lacked elaboration. This suggests that S2 is still operating within conventional thinking patterns without engaging in deeper exploration. This finding is consistent with previous research indicating that students with moderate levels of creativity tend to produce a single solution and rarely reflect on their own thinking processes [24]. Thus, S2's creative thinking ability appears to be at a transitional stage, where the student understands mathematical concepts but has not yet developed the ability to expand or interpret ideas in a meaningful way. Viewed through Torrance's framework, S2 demonstrated moderate fluency but weak flexibility and elaboration, indicating partial development of creative thinking that requires further instructional support.

Meanwhile, S3 demonstrated relatively low creative thinking ability. The student only calculated the average yield and wrote a brief conclusion without detailed reasoning or additional interpretation. There was no evidence of revisiting calculations, linking results to the problem context, or exploring alternative solutions. This condition indicates weaknesses in flexibility and elaboration, as S3's reasoning remained linear and focused on one "correct" procedure. This result supports findings that students with average and low achievement levels often struggle with fluency and flexibility, tending to rely on familiar methods and facing difficulties in developing alternative representations or strategies in problem-solving [25]. Hence, S3's reasoning pattern reflects students who are not yet accustomed to engaging with open-ended problems that require in-depth exploration of ideas. From Torrance's perspective, S3's performance illustrates minimal fluency, limited flexibility, and little elaboration, suggesting a need for scaffolding to encourage divergent thinking.

Overall, the findings confirm that students' creative thinking ability is revealed not only through correct answers but also through how they explain, connect, and interpret their problem-solving processes. S1 displayed high-level creative thinking, characterized by originality and reflective reasoning. S2 demonstrated a moderate level, with convergent but underdeveloped elaboration, while S3 exhibited limited procedural thinking. These results reinforce previous research suggesting that open-ended problem-solving tasks encourage students to generate diverse ideas, broaden their perspectives on mathematical concepts, and naturally develop their creative thinking abilities.

The findings also have implications for teaching practice. Open-ended tasks should be integrated more consistently into classroom instruction to encourage fluency, flexibility, and elaboration. Teachers may need to provide guided questioning, scaffolding, or reflective prompts to help students like S2 and S3 move beyond procedural reasoning toward more creative responses.

Contextual factors also contributed to the variations in students' creative thinking. SMA Negeri 14 Kota Jambi is implementing the Merdeka Curriculum, which emphasizes higher-order thinking, yet students still have limited exposure to open-ended statistical tasks. This may explain why students with lower achievement levels were unfamiliar with generating multiple solutions or providing detailed explanations. Students' diverse academic backgrounds and learning experiences also shape their readiness to engage with open-ended problems, suggesting that the development of creative thinking is influenced not only by task design but also by the instructional context.

4. CONCLUSION

Based on the exploration of students' creative thinking abilities in solving open-ended problems on statistical topics, it was found that each student demonstrated distinct thinking characteristics according to their ability level. The high-achieving student (S1) demonstrated strong creative thinking skills, characterized by fluency in generating ideas, flexibility in adjusting strategies, and the ability to elaborate on results comprehensively and contextually. This student was also able to interpret the outcomes reflectively and connect them to the situational meaning of the problem.

In contrast, the medium-achieving student (S2) tended to display procedural thinking. Although capable of obtaining correct answers, this student did not develop alternative strategies or provide in-depth explanations for them. This indicates that S2's creative thinking ability is at an intermediate stage, able to understand mathematical concepts but not yet fully capable of divergent thinking.

Meanwhile, the low-achieving student (S3) showed a reasoning pattern limited to routine procedures without additional elaboration. The student followed basic computational steps without connecting them to the problem's context, indicating low levels of flexibility and originality. Overall, this study demonstrates that students' mathematical creative thinking develops in line with their ability to interpret, connect, and communicate mathematical ideas reflectively.

The findings of this study offer practical implications for teaching statistics. Teachers are encouraged to integrate open-ended tasks more consistently to create learning environments that stimulate fluency, flexibility, originality, and elaboration. Such tasks can help students at various ability levels explore multiple solution paths and develop deeper reasoning. This study has several limitations. The number of participants was small, and the analysis focused only on three students, which restricts the generalizability of the findings. The study was also limited to a single school context, which may influence the types of strategies students demonstrated.

Future research may involve a larger and more diverse sample to gain a broader understanding of students' creative thinking in statistical problem-solving. Further studies could also examine the role of instructional interventions, such as scaffolding or collaborative learning, in supporting students' creative thinking processes.

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