Analysis of Students' Creative Thinking Abilities in Mathematics Problems on Arithmetic Sequences and Series at SMA Negeri 1 Sedayu

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Abstract

This study employs a descriptive qualitative approach, utilizing a case study method, to explore students' creative thinking abilities in depth when solving mathematical problems related to arithmetic sequences and series. The research subjects were 35 grade X students of SMA Negeri 1 Sedayu who were selected using a purposive sampling technique. Data were collected through essay tests that measure four indicators of creative thinking abilities: fluency, flexibility, originality, and elaboration, as well as semi-structured interviews and documentation of student work results. Data validity was tested through triangulation and observational persistence. The results showed that most students were classified as creative to very creative (77.1%). Fluency and flexibility aspects dominated, while originality and elaboration still varied among students. This study emphasizes the importance of providing open-ended questions and reflective learning to improve mathematical creative thinking abilities.

Keywords: creative thinking, sequences and series, Guilford's theory, mathematics learning

Introduction

Creative thinking skills are a crucial 21st-century competency to develop in mathematics learning. These skills reflect students' ability to generate diverse, flexible, original, and detailed ideas to solve complex problems (Krisdarani et al., 2024). In the context of mathematics learning, creative thinking plays a significant role in developing students' reasoning and innovation skills when faced with non-routine problems that require the exploration of new concepts and strategies (Ariyanto et al., 2025). Especially in the topic of sequences and series, students are required not only to understand the concept of number patterns and general formulas but also to interpret and construct mathematical models from real-life contexts (Qadri et al., 2019). Therefore, an analysis of students' creative thinking skills in solving sequence and series problems is essential, since these mathematical topics offer opportunities to evaluate students' divergent thinking and their capacity to generate multiple solution strategies.

However, empirical evidence consistently indicates that many students still experience difficulties in solving mathematical problems that require creative thinking. Previous studies have shown that students tend to rely heavily on algorithmic procedures

and routine steps, with limited exploration of alternative ideas or solution strategies (Nufus et al., 2024). Similar findings were reported in several Indonesian high schools, where students demonstrated low levels of fluency, flexibility, originality, and elaboration, particularly when dealing with non-routine problems (Fineldi & Hidayati, 2023). International research further confirms that instructional practices emphasizing procedural fluency over conceptual understanding contribute to low levels of mathematical creative thinking (Jonsson et al., 2022).

In the context of SMA Negeri 1 Sedayu, preliminary classroom observations and discussions with mathematics teachers indicate that students tend to perform well on routine exercises but face significant challenges when solving non-routine sequence and series problems that demand higher-order thinking. This condition is closely related to student learning habits, curriculum implementation that prioritizes examination-oriented outcomes, and limited exposure to open-ended problem-solving tasks. Therefore, a contextual study at SMA Negeri 1 Sedayu is crucial to map students' creative thinking abilities in sequences and series as a basis for designing more effective instructional interventions.

Mathematical creative thinking ability is generally measured through four main indicators, namely fluency, flexibility, originality, and elaboration (Suherman & Vidákovich, 2025). These four indicators are widely used in research as a conceptual framework in assessing the level of student creativity in solving mathematical problems (Safaria & Agus, 2024). Research conducted by Manurung et al., (2024) demonstrates that creative thinking ability can be developed through character-based learning, which fosters the values of responsibility and initiative in thinking. Additionally, the application of the discovery learning model has been shown to be effective in enhancing students' flexibility and originality in solving mathematical problems (Rosmawati et al., 2024). Research by Ariyanto et al., (2025) also confirms that a contextual approach, which links mathematics to real-world situations, can significantly foster student creativity. Thus, an in-depth analysis of creative thinking ability in sequences and series material is an important basis for the development of innovative learning models.

Although several previous studies have examined mathematical creative thinking skills at various levels and learning topics, research specifically examining these abilities in the context of arithmetic sequences and series in a local setting, such as SMA Negeri 1 Sedayu, remains very limited. Most previous studies have focused on improving creative thinking skills through the application of specific learning models, rather than conducting an

in-depth analysis of the characteristics of students' creative thinking skills in problem-solving. This limitation highlights a research gap that needs to be addressed to gain a more comprehensive understanding of how students exhibit aspects of fluency, flexibility, originality, and elaboration in the context of authentic mathematics learning.

Previous studies have shown that students' creative thinking skills still require systematic improvement. Research by Khoirunnisa et al., (2024)found that most students were unable to demonstrate various strategies and new ideas for solving sequence and series problems. Research by Nurdin et al., (2024) revealed a positive correlation between creative thinking skills and learning independence, as well as student self-concept. Furthermore, Yulianto et al., (2021)added that cognitive style also influences how students display originality in mathematical creative thinking. A similar condition was also identified by Saefudin et al., (2023), who highlighted that learning in schools often emphasizes the final result rather than the creative thinking process. Therefore, research at SMA Negeri 1 Sedayu is important for identifying how students' local characteristics influence their creative thinking abilities, while also examining the problem-solving patterns they employ.

As part of the initial research phase, researchers conducted preliminary observations on Tuesday, August 7, 2025, in class X-1 of SMA Negeri 1 Sedayu. Based on the results of these observations, several important findings were discovered. Among the positive aspects implemented at SMA Negeri 1 Sedayu is that teachers have delivered material clearly and coherently, enabling students to understand the steps for solving routine problems effectively. However, an apparent obstacle is that the questions given are still procedural and do not provide a stimulus for students to think creatively. Students appear to be passive and do not explore alternative ways to solve problems. This condition suggests that students' creative thinking skills have not been fully developed. The implication for research is the need to develop specialized question instruments that encourage students to think creatively, for example, by presenting open-ended questions with multiple possible solutions. The results of these observations reinforce the need for further research to analyze students' creative thinking skills in the context of arithmetic sequences and series in greater depth.

On the other hand, other researchers have also emphasized the importance of developing creativity in mathematics learning. Research by Ibrahim et al., (2024) found that a learning orientation that balances creative thinking skills and creative dispositions can significantly improve students' mathematical performance. Research Hansen (2022) also emphasized that collaboration and student autonomy are key to fostering creative thinking.

Meanwhile, a study by Suherman & Vidákovich (2025) showed that process-based assessments are more effective in assessing creativity than outcome-based assessments. Therefore, this research is expected to provide an empirical contribution to the development of mathematics learning that focuses on strengthening creative thinking skills at SMA Negeri 1 Sedayu, while also serving as a practical reference for teachers in optimizing student potential through questions that challenge high-level creative thinking.

Thus, the implication of this research is the need to develop special question instruments that can encourage students to think creatively, for example, through open-ended questions that allow more than one way or a correct answer. This kind of instrument is expected to be able to assess students' creative thinking abilities more authentically and comprehensively. This observation highlights the need for research to examine students' creative thinking abilities in mathematics problems involving arithmetic sequences and series at SMA Negeri 1 Sedayu, thereby providing a basis for teachers to design more innovative, reflective, and challenging learning experiences that foster students' critical thinking.

Method

This research employed a descriptive qualitative design with a case study approach, aiming to explore students' creative thinking skills in solving mathematical problems related to arithmetic sequences and series. This approach enables an in-depth understanding of students' natural thought processes through narrative and interpretative analysis, providing a comprehensive depiction of the ideas, strategies, and reasoning patterns demonstrated by students when confronting tasks that require creative thinking. Although students' responses were organized into levels to facilitate systematic description, the primary focus of the analysis remained on qualitative interpretation rather than numerical measurement or statistical inference. Thus, the study is epistemologically grounded in a qualitative research paradigm (Mahmudah & Jatisunda, 2025; Yulia et al., 2021).

The research participants consisted of 35 tenth-grade students from a public senior high school. These students constituted the study population and were involved in the initial phase of data collection. From this population, purposive sampling was employed to select eight students as focal subjects for in-depth analysis. The selection criteria were based on students' initial mathematics assessment results, which classified their academic abilities into four levels: low, lower-middle, upper-middle, and high. Two students were selected

from each ability level to ensure a balanced representation of diverse mathematical competencies. The classification and selection process was conducted in consultation with the mathematics teacher to verify the accuracy of students' academic profiles. This procedure was implemented to enhance the validity of the selected samples and to minimize selection bias by ensuring that the subjects adequately reflected the range of abilities relevant to the research objectives (Ahmad & Wilkins, 2025; Purbaningrum & Palupi, 2022).

Data were collected through tests, semi-structured interviews, and documentation. The first stage involved administering an open-ended essay-based test on arithmetic sequences and series designed to measure four dimensions of creative thinking ability based on Guilford's theory: fluency, flexibility, originality, and elaboration. The validation process was conducted by a mathematics education lecturer and a high school mathematics teacher. The lecturer was chosen because of his expertise in curriculum development. The teacher was chosen because of his experience teaching sequences and series. The test instruments used consisted of written test items and a list of interview questions. The aspects validated in the written test items were Content Assessment, Construct Assessment, Language Assessment, and a four-point scale assessment. The results were analyzed to determine the level of question validity, and several revisions were made based on suggestions provided by the validator. Following the test, semi-structured interviews were conducted with selected students to explore their thinking processes, problem-solving strategies, and the rationale for their chosen problem-solving steps. The interviews were recorded, transcribed verbatim, and analyzed in conjunction with the test results to gain a comprehensive understanding of students' creative thinking abilities (Margaretha & Hidayat, 2023). Furthermore, documentation was conducted in the form of field notes, activity photos, and video recordings to complement and confirm the observational and interview data. This triangulation approach between methods helps strengthen the validity and reliability of the research results (Asipi et al., 2022).

Research instruments consist of two types: primary instruments and supporting instruments. The researcher acts as the primary instrument, responsible for the entire research process, from data collection to analysis and interpretation. Supporting instruments include creative thinking ability test sheets and interview guidelines. The test questions are descriptive, requiring students to express their thought processes in detail, while the interview guidelines are structured based on indicators of creative thinking ability, serving

to gather additional information about students' thinking patterns when solving problems (Mahmudah & Jatisunda, 2025).

Data validity was tested through source triangulation and observational diligence. Triangulation was conducted by comparing test results, interviews, and documentation to obtain consistent information from various perspectives. Observational diligence was ensured by reviewing work results and repeatedly reviewing field notes to verify the accuracy of research findings (Asipi et al., 2022). Data analysis was conducted in three main stages: data reduction, data presentation, and drawing conclusions/verification. During the reduction stage, students' written responses were examined using creative thinking indicators fluency, flexibility, originality, and elaboration which were operationalized through open-ended essay tasks and assessed using an analytic scoring rubric. Each indicator was scored based on the quality and completeness of students' responses. The scores for each indicator were then accumulated and converted into percentages to facilitate descriptive interpretation. Based on these percentages, students' creative thinking abilities were classified into five levels: very creative, creative, moderately creative, less creative, and very less creative. These numerical classifications served as supporting descriptors, while the primary analysis emphasized qualitative interpretation of students' solution strategies and reasoning processes (Anggela et al., 2022).

Calculation of creative thinking ability test scores:

$$\text{TKBK} = \frac{S_{fl} + S_{fx} + S_{or} + S_{el}}{S_{\text{maks}}} \times 100\% \quad (1)$$

Table 1. Creative Thinking Ability Level Categories

Interval (%)	Creative Thinking Ability Level Categories
81 – 100	Very Creative
61 – 80	Creative
41 – 60	Moderately Creative
21 – 40	Less Creative
< 21	Very Little Creative

Source: modification of (Anggela et al., 2022)

Results and Discussion

This section presents the empirical results and their discussion derived from a qualitative descriptive case study conducted in class X 1 of SMA Negeri 1 Sedayu. This section presents the research results on students' creative thinking abilities in solving

mathematical problems related to arithmetic sequences and series. The analysis focused on four indicators of creative thinking abilities, as outlined in Guilford's theory: fluency, flexibility, originality, and elaboration. The research data were obtained from the results of essay tests given to 35 class X students of SMA Negeri 1 Sedayu and semi-structured interviews with 8 selected students representing the high, medium, and low ability categories based on the test results.

Based on the results of the students' creative thinking ability test in mathematics, the students' test scores for the material on arithmetic sequences and series are presented in Table 2.

Table 2. Results of the Descriptive Test of Students' Creative Thinking Ability.

No	Name	Indicator fluency	Indicator flexibility	Indicator originality	Indicator elaboration	Total score	Percentage
1	S1	0	1	0	1	2	12,5%
2	S2	0	2	0	1	3	18,75%
3	S3	0	2	3	1	6	37,5%
4	S4	2	3	0	1	6	37,5%
5	S5	2	4	1	1	8	50%
6	S6	2	4	1	1	8	50%
7	S7	2	4	2	1	9	56,25%
8	S8	4	4	0	1	9	56,25%
9	S9	1	4	4	1	10	62,5%
10	S10	2	4	3	1	10	62,5%
11	S11	2	4	3	1	10	62,5%
12	S12	2	4	3	1	10	62,5%
13	S13	2	3	4	1	10	62,5%
14	S14	2	4	3	1	10	62,5%
15	S15	2	4	4	1	11	68,75%
16	S16	2	4	4	1	11	68,75%
17	S17	2	4	4	1	11	68,75%
18	S18	1	2	4	4	11	68,75%
19	S19	2	4	4	1	11	68,75%
20	S20	2	4	4	1	11	68,75%
21	S21	2	4	4	1	11	68,75%
22	S22	2	4	4	2	12	75%
23	S23	2	4	4	2	12	75%
24	S24	2	3	3	4	12	75%

25	S25	1	4	4	4	13	81,25%
26	S26	2	4	3	4	13	81,25%
27	S27	2	4	4	4	14	87,5%
28	S28	2	4	4	4	14	87,5%
29	S29	4	2	4	4	14	87,5%
30	S30	2	4	4	4	14	87,5%
31	S31	2	4	4	4	14	87,5%
32	S32	4	3	4	4	15	93,75%
33	S33	3	4	4	4	15	93,75%
34	S34	4	4	4	4	16	100%
35	S35	4	4	4	4	16	100%

From the results of students' creative thinking ability scores, the percentage of creative thinking ability per indicator is obtained, presented in Table 3.

Table 3. Recapitulation of Creative Thinking Ability Test Results for Grade X Students of SMA Negeri 1 Sedayu.

Creative Thinking Ability Category	**Percentage Range Score**	**Number of Students**	**Percentage**
Very Creative	81% - 100%	11	31,4%
Creative	61% - 80%	16	45,7%
Moderately Creative	41% - 60%	4	11,4%
Less Creative	21% - 40%	2	5,7%
Very Less Creative	< 21%	2	5,7%
Total		35	100%

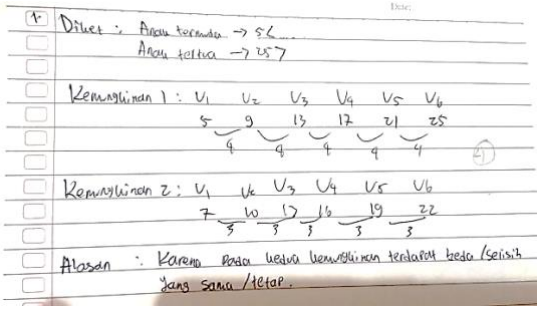
Overall, 27 students (77.1%) were included in the Creative and Very Creative categories. However, 22.8% of students are still categorized as Moderately Creative, Less Creative, or Very Less Creative, indicating differences in creative thinking abilities among students.

The Fluency aspect, or fluency of creative thinking, refers to students' ability to generate multiple ideas or alternative solutions to solve math problems. Based on the analysis, most students scored 2-4 on this indicator. The flexibility aspect assesses students' ability to switch strategies or change approaches when faced with difficulties. Test results showed that 25 students (71.4%) demonstrated high flexibility, with scores ranging from 3 to 4. The originality aspect measures students' ability to generate unusual ideas, differ from most answers, and demonstrate innovative thinking. Based on the test results, 11 students (31.4%) demonstrated a high level of originality. The elaboration aspect assesses students' ability to develop and detail their ideas in depth. Students with high elaboration are able to

explain solution steps coherently and logically, while students with low elaboration have difficulty communicating their thought processes.

Students with high fluency tended to be dissatisfied with a single solution. Students in the Very Creative category were able to write down two different solutions.

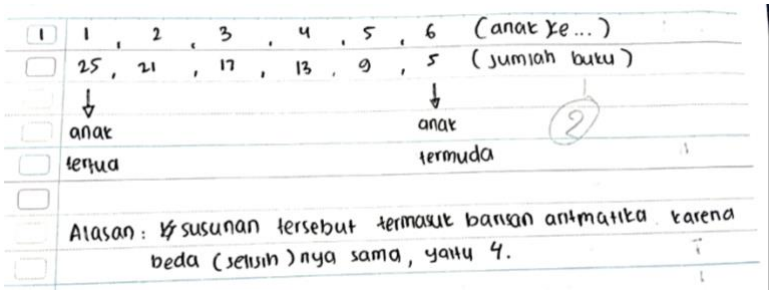
The following is an example of student work in the Very Creative and Creative categories represented by subject S35.



Picture 1. Examples of Very Creative and Creative student answers in the fluency aspect

From the results of the work, it can be seen that subject S35 not only used one possibility, but also tried several possibilities to test the accuracy of his answer. This shows the fluency of thinking in producing varied ideas. This finding is reinforced by the results of the interview with subject S35, who revealed, "The strategy I used was, my father distributed books to six boys, the youngest 5 books, the oldest 25 books. where the numbers for the youngest children were 3 digits apart, the middle 4 digits, and the oldest 5 digits." This quote shows that students have metacognitive awareness in their thinking process. He not only followed one pattern, but also evaluated the truth by comparing the results of different strategies. This is consistent with (Indrapangastuti et al., 2025) who reported that students in the creative category showed high fluency scores, characterized by their ability to produce various different solution methods for one mathematical problem.

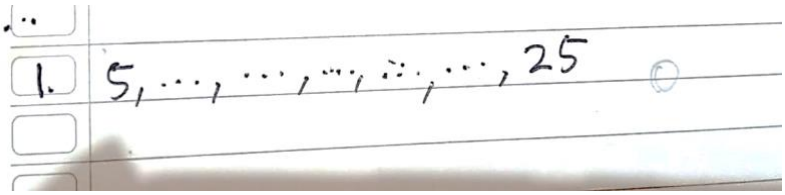
The following is an example of student work in the Quite Creative category represented by subject S22.



Picture 2. Examples of Student Answers that are Quite Creative in the Fluency Aspect

The results of this work indicate that subject S22 has moderate creative fluency, capable of generating only one possibility. They tend to follow standard patterns with little additional exploration. This finding is reinforced by the results of an interview with student S22, who stated, "I understand the problem and look for important data, then determine the appropriate formula." This statement indicates a divergent thinking process, where subject S22 attempts to ensure the logic of the solution through two thought paths: visual (pattern) and symbolic (formula). This finding is in line with (Riansyah et al., 2024) who concluded that students with intermediate creativity are often still limited to one solution approach without significant variation.

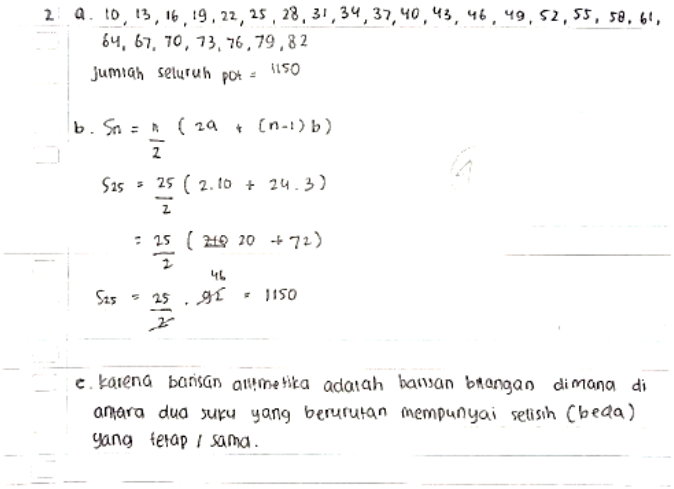
In contrast, students in the less creative category, represented by subject S1, did not find the answer to the question; they only wrote down the question, but did not produce several possible answers.



Picture 3. Examples of Less Creative Student Answers in the Fluency Aspect

The results of the interview with the S1 subject showed that limited fluency was caused by a lack of confidence and experience in exploring alternative answers, "the strategy I used was, the father distributed books to six boys, the youngest 5 books, the oldest 5 books" from the interview and the written work results above, it is seen that fluency ability is closely related to cognitive activity and students' attitudes towards problem solving. Students who actively explore new ideas tend to exhibit high fluency, whereas students who rely on a single formula tend to show low fluency. This is in accordance with (Sari & Amir, 2025) who reported that students with low creativity showed low fluency in the context of solving mathematical problems.

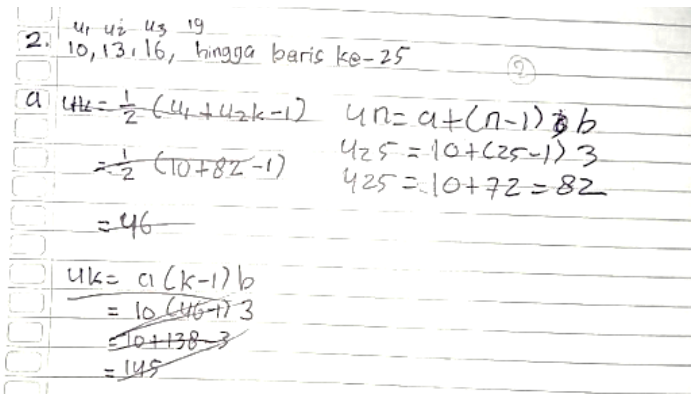
Students demonstrated high flexibility by solving a single problem using two different approaches.



Picture 4. Examples of Very Creative and Creative Student Answers in the Flexibility Aspect

Based on the image above, it is shown that subject S25 is able to solve problem number 2 using two methods and the questions from the problem are answered correctly. Subject S25 is able to solve the problem using two different methods. This finding is reinforced by the results of the interview represented by subject S25, who showed the reasons why he used the two strategies "I will make two ways of equations from the series formula and manual calculations or logic, the first method is by adding one number to another number continuously so that the result is found without a formula, the second method uses the Sn formula" this statement shows that the student has strong flexibility of thinking. he not only focuses on applying the formula, but also tries to link general concepts (formulas) and concrete representations (number patterns). This finding aligns with (Indrapangastuti et al., 2025) who reported that creative students demonstrated the highest flexibility scores among their creativity indicators.

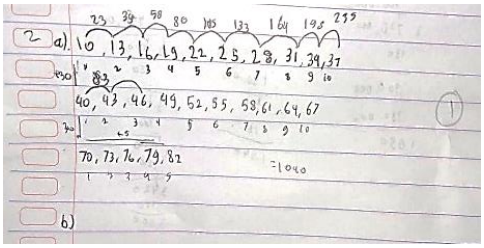
Meanwhile, subject S29 in the Quite Creative category displayed only slight variations in procedures, such as changing the order of substitutions without altering the approaches.



Picture 5. Example of Student Answers that are Quite Creative in the Flexibility Aspect

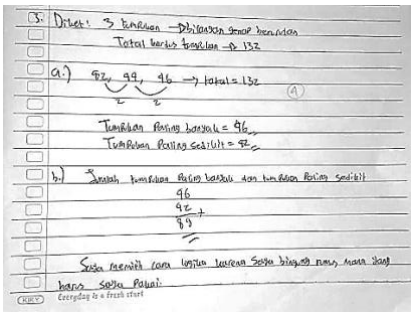
Interview excerpts reveal that the student tends to rely on a single source and is reluctant to explore alternative approaches (e.g., "I don't know, there aren't any"). This suggests that while the student is able to adapt strategies internally, they are not yet fully confident in exploring completely different approaches. Flexibility is still at the creative stage. This is in line with (Sari & Amir, 2025) who found that intermediate students could only make minor modifications without significant strategy changes.

In contrast, S1 subjects with less creative flexibility appear to use the same method for all questions, but the results of the work are incorrect.



Picture 6. Example of a less creative student's answer in the flexibility aspect

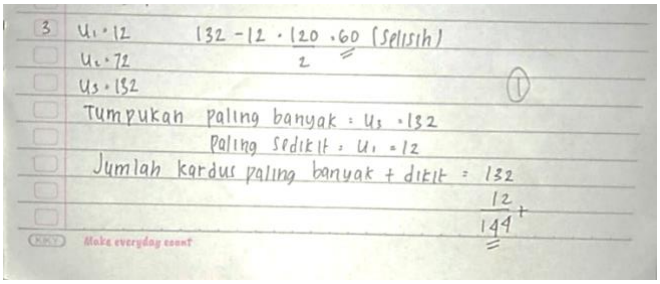
Interview excerpts show that the student tends to rely on one source (teacher or textbook) and has not dared to try other methods "I don't think there is another way, because it's too difficult, I don't understand it" This statement shows that the limited flexibility of students' thinking is not only due to a lack of conceptual understanding, but also due to affective factors, such as fear of making mistakes or reluctance to try new approaches. This finding is consistent with (Putra et al., 2024), who asserted that students with low flexibility tend to stick to one method without exploring alternatives.



Picture 7. Example of Very Creative and Creative Student Answers in the aspect of originality

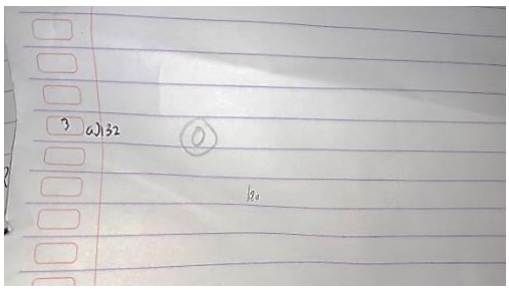
Based on the image above, student S35 demonstrates originality by connecting the problem to a unique book distribution context, different from the standard approach. This is supported by the results of the interview with subject S35 who said "from determining the three differences in the total of the boxes, I found the total number of boxes that had been determined. With this strategy, I can solve the problem faster" from the explanation of the interview with subject S35, this manual approach is unique, although simple, and shows

originality for students who are less accustomed to using formulas. This finding aligns with the research of (R. Y. Putri et al., 2024) who reported that students with high mathematical creative thinking skills not only meet the originality indicator but are also able to demonstrate solutions that differ from conventional approaches and meet all creative thinking indicators.



Picture 8. Example of student answers: Quite creative in terms of originality

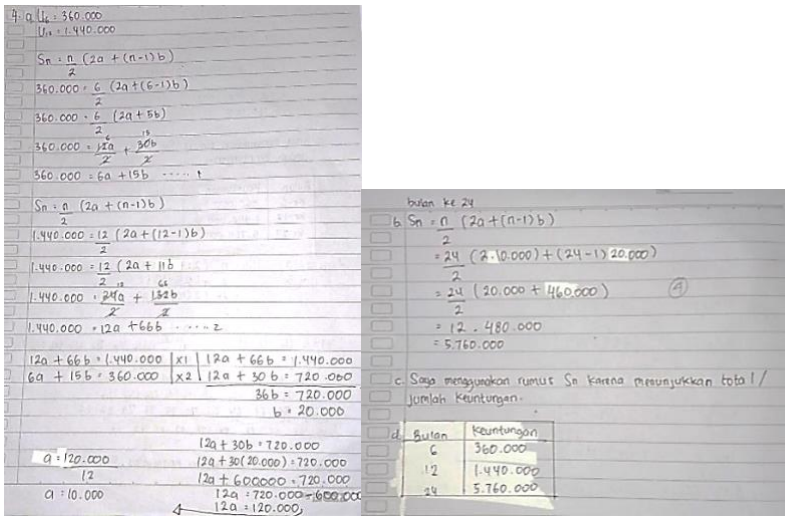
Based on the student's work in the picture above, it appears that subject S14 employs standard solution steps but shows slight variations in how to present information. There are errors in the results of the work, which can be categorized as quite creative in terms of originality. These results are reinforced by the results of interviews with subject S14 who stated "because I understand better if calculated manually, it is easier to understand and makes me know the flow" from the results of the interview showed an effort to compile unique steps independently, a combination of step presentation, courage to use personal methods, and imperfections in the results, placing the originality ability of subject S14 at a fairly creative level, namely being able to produce their own ideas but not yet fully original or mathematically correct. This aligns with the findings of (Palwa et al., 2024), who showed that students with moderate mathematical creativity tend to meet the originality indicator through ideas based on their self-concept, but are not yet fully consistent or mathematically accurate.



Picture 9. Example of student answers that are less creative and in terms of originality

Based on the results of the S2 subject's work, it appears that the student did not demonstrate a clear mathematical thinking process, and there was no apparent attempt to create new strategies or unique ideas in solving arithmetic sequence and series problems. The results of this work are supported by the results of interviews with S2 subjects who

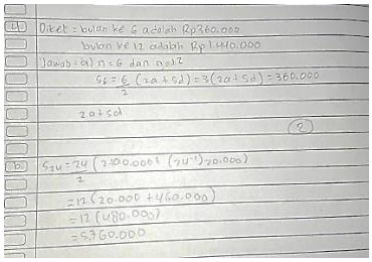
stated "I can't, I don't understand" this is evident from the absence of identifiable mathematical creative thinking processes, because S2 subjects did not write down the solution steps, did not organize information, and did not show any attempt to try any strategies in solving arithmetic sequence and series problems. The student's work did not display ideas, patterns, or independent approaches that are categorized as mathematical creativity. The combination of the absence of solution steps, minimal understanding of concepts, and the inability to develop ideas places the originality aspect of S2 subjects in the very low category, because there was no indication of creative thinking that emerged in the problem-solving process. This view aligns with the findings of (Hanifah et al., 2024) who stated that students with low levels of originality tend to only be able to fulfill a small portion of the indicators of creative thinking. Students in this category often only use conventional approaches and do not demonstrate novel ideas in their written solutions because they have not been able to develop alternative strategies that demonstrate novelty or creativity in answering mathematical problems.



Picture 10. Example of Very Creative and Creative Student Answers in the elaboration aspect

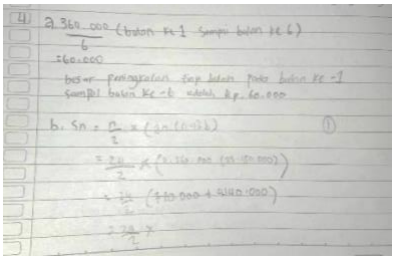
Based on the written test results of subject S35, it is clear that subject S35 is able to solve arithmetic sequences and series problems with complete, coherent, and systematic steps. This is demonstrated through a clear calculation process, starting with the determination of the value of the first term and the difference, developing the formula for the sum of the first n terms, and then producing two equations that are solved using the elimination and substitution methods. Subject S35 wrote each stage in a structured manner, such as changing the form of the formula, multiplying equations, and eliminating variables, until finding the values of a and b. Furthermore, subject S35 also calculated the total profit up to the 24th month using the Sn formula and obtained a final result of Rp 5,760,000. This

solution demonstrates good elaboration skills, as subject S35 not only presented the final result but also included the reasons for using the formula and a detailed calculation flow. These findings were further strengthened by the results of interviews with subject S35, who explained that he realized the importance of complete steps to ensure the correctness of the calculations. Subject S35 stated, "Yes, from finding the first term, the difference, then up to the total amount, I checked the results, I checked from the beginning, and I also made sure the calculations were correct, the steps were complete. The total profit in the 6th month was Rp 360,000, and by the 12th month, it had increased to Rp 1,440,000. The first thing I did was determine equations 1 and 2. To find the equation, I used the formula Sn equals N per 2 in parentheses 2A plus in parentheses N-1 close parentheses B close parentheses. After I got equations 1 and 2, I eliminated to get the result B equals Rp20,000. After that, I substituted the difference into Equation 1, which gave me the result A = Rp 10,000. Then, the question asked was about the total profit in the 6th month, which was Rp 360,000, and in the 12th month, it was Rp 1,440,000. The first thing I did was determine equations 1 and 2. To find the equation, I used the formula Sn equals N per 2 in parentheses 2A plus in parentheses N-1 close parentheses B close parentheses. After I obtained equations 1 and 2, I used elimination to get the result B equals Rp 20,000. After that, I substituted the difference into Equation 1, which gave me the result A = Rp 10,000. Then, in the question asked, the profit for the first month was Rp 10,000, and the amount of the increase was Rp 20,000. After that, I looked for the amount until the 24th month, the result was Rp5,760,000". This oral explanation demonstrates that the subject has a strong conceptual understanding and is able to articulate his thought process effectively, which is a dominant indicator that the student's elaboration aspect falls into the creative category, specifically towards the very creative end. This finding aligns with (Nurdiana & Caswita, 2024), who showed that students with high mathematical creative thinking skills, particularly in the aspect of elaboration, are able to compile detailed problem-solving descriptions and systematically explain their thought processes. The clear and logical description of the steps reinforces the character of elaboration as the ability to explain ideas in depth, rather than simply providing a final answer.



Picture 11. Example of student answers that are quite creative in the elaboration aspect

Based on the results of subject S22's work in the image above, subject S22 demonstrated elaboration skills in the moderately creative category, marked by the presentation of solution steps that were beginning to be structured but not yet fully complete. Subject S22 was able to write down important information from the problem, such as the values of S6 and S12, then used the formula for the sum of an arithmetic series to construct the two initial equations. However, the steps written were still less detailed than those in the high elaboration category; subject S22 had not explained the elimination process completely, and several calculation steps were only written in the form of final results without a description of the step-by-step transition. The findings of the test results are consistent with subject S-22's statement in the interview, who said, "Yes, I start by writing down what I know, then the formula I use, then do the calculations step by step until the end. And finally, I recheck the final result." This statement suggests that subject S22 tends to work sequentially and often rechecks the results of his work. Subject S22's elaboration ability falls into the moderately creative category, characterized by the ability to arrange sequential steps for solving problems and verify results. However, it is still limited in explaining mathematical reasons and the details of the calculation process as a whole. Subject S22 has been able to demonstrate a clear line of thought, but the level of elaboration depth is still moderate and has not yet reached the high or very creative category. This finding is consistent with Prayudho (2024) who described that students with moderate elaboration are generally able to present a clear sequence of steps but are still limited in explaining transitions and mathematical reasoning, thus not showing in-depth and coherent elaboration in each stage of problem-solving.



Picture 12. Example of less creative student answers in the elaboration aspect

Based on the written test results, subject S9 demonstrated elaboration skills that were classified as less creative. This was evident in the solution that was not explained in detail, where the student immediately wrote the calculation without systematically outlining the process steps. Subject S9 did not demonstrate the process of substituting values into the formula, so the mathematical thought process could not be clearly traced. Furthermore, the calculation results obtained were also incorrect. This condition was reinforced by the interview results, which stated that subject S9 "didn't know and didn't understand," indicating that the student did not yet understand the concept of problem solving and had difficulty expressing his thought process in writing. This finding aligns with (Fitria et al., 2023) who stated that students with low elaboration skills often cannot construct complete and coherent descriptions, resulting in unclear understanding of problem-solving steps. This is due to limited conceptual mastery and students' habit of presenting incomplete steps in solving mathematical problems.

The results showed that the majority of students fell into the Creative and Very Creative categories. This finding indicates that students are relatively capable of handling non-routine problems on arithmetic sequences and series that require divergent thinking. The dominance of the Creative category indicates that students are accustomed to generating more than one idea and using diverse strategies to solve mathematical problems.

Fluency and flexibility were the most prominent indicators in this study. Students with high fluency were able to generate several alternative solutions, while flexibility was reflected in the ability to switch strategies when faced with difficulties. This finding is in line with (Mahmudah & Jatisunda, 2025) and (Indrapangastuti et al., 2025) who stated that creative students tend not to be fixated on one solution method and actively explore various possibilities. Although fluency and flexibility were quite high, originality showed greater variation. Only a small proportion of students were able to present solutions that were truly different from the common approach. This suggests that originality requires a deeper understanding of concepts and the courage to deviate from standard procedures. This finding aligns with (Rizqi, 2023) and (D. M. Putri et al., 2024) who stated that originality is the most difficult indicator of creative thinking to develop. Variations in elaboration ability indicate differences in the depth of students' understanding. Students with high elaboration are able to explain the solution steps coherently and logically, while students with low elaboration have difficulty communicating their thought processes. This finding supports the research of (Nurdiana & Caswita, 2024), which states that elaboration is an important indicator of the

depth of mathematical creative thinking. Variations in originality and elaboration demonstrate the need for learning that focuses not only on the final result but also on students' thinking processes. Providing open-ended problems and reflective activities can encourage students to develop more original ideas and explain solutions in greater depth. These findings support the view of (Istiqomah & Lestari, 2024) that reflective learning plays a crucial role in improving students' mathematical creative thinking.

Conclusion and Suggestion

This descriptive qualitative study concluded that the majority of 10th-grade students of SMA Negeri 1 Sedayu (77.1%) were classified as having creative mathematical thinking skills in the creative and very creative categories on arithmetic sequences and series. The dominance of students' creative thinking skills was clearly visible in the fluency and flexibility indicators, where students were able to generate various alternative solutions and use different approaches in solving problems. However, greater variation in abilities was found in the originality and elaboration indicators. Students with high originality were able to present unique solutions and were not fixated on standard formulas. Good elaboration was demonstrated through the presentation of complete, coherent, and systematic solution steps. Limitations in the originality and elaboration aspects for some students were associated with a lack of confidence and a tendency to follow standard algorithmic steps, indicating that these abilities have not been optimally honed. Therefore, this study confirms that to optimize students' mathematical creative thinking potential, it is crucial to present challenging open-ended problems and implement reflective learning.

Based on these findings, it is recommended that mathematics teachers consistently integrate open-ended questions into assessments to stimulate fluency and flexibility, and emphasize detailed thinking processes to enhance elaboration skills. Furthermore, it is essential to create a learning environment that fosters students' autonomy and encourages them to explore new strategies, thereby promoting the emergence of original ideas. For further research, it is recommended to conduct experimental studies to test the effectiveness of specific learning models in significantly improving aspects of originality and elaboration, as well as to examine the influence of cognitive and affective factors on mathematical creative thinking skills.

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