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Profile of Junior High School Students' Creative Thinking Abilities in Solving Open-Ended Problems on Number Patterns Material

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ABSTRACT

Learning in the 21st century must be transformed from traditional to modern learning. This change is necessary to equip students with 21st-century skills, known as the 4Cs (Communication, Collaboration, Critical Thinking, Creativity). One of the skills that students must master in the 21st century is creativity or creative thinking skills. Creative thinking skills are essential for all students to master at every level of education. This study aims to describe the profile of junior high school students' creative thinking skills in solving open-ended problems in the number pattern material. Creative thinking is the ability to express original ideas, while open-ended questions are problems or questions that have many correct answers. Fluency, flexibility, and novelty are the indicators of creative thinking skills used. The method used in this study is to use a descriptive method with a qualitative approach. Data collection in this study was carried out by giving a test about the ability to think creatively. After the creative thinking ability test, three subjects with high, medium, and low creative thinking abilities were selected for the interview. Then the results of the interviews will be analyzed using the time triangulation method. The results of this study concluded that subjects with a high category of creative thinking abilities, subject fulfilled the three indicators of fluency, flexibility, and novelty. In subjects with the medium category of creative thinking ability, it was found that subjects only met the indicators of fluency and flexibility. Meanwhile, subjects with low-category creative thinking abilities found that students did not meet the three indicators of creative thinking ability.

Keywords**:** *creative thinking, open-ended, number patterns.*

Profil Kemampuan Berpikir Kreatif Siswa SMP Dalam Menyelesaikan Masalah Open-Ended Pada Materi Pola Bilangan

ABSTRAK

Pembelajaran di abad ke-21 harus diubah dari pembelajaran tradisional menjadi pembelajaran modern. Perubahan ini diperlukan untuk membekali siswa dengan keterampilan abad ke-21, yang dikenal sebagai 4C (Komunikasi, Kolaborasi, Berpikir

Kritis, Kreativitas). Salah satu keterampilan yang harus dikuasai oleh siswa di abad ke-21 adalah kreativitas atau keterampilan berpikir kreatif. Kemampuan berpikir kreatif sangat diperlukan untuk dikuasai oleh seluruh siswa yang belajar di seluruh jenjang pendidikan. Penelitian ini bertujuan untuk mendeskripsikan kemampuan berpikir kreatif siswa SMP dalam memecahkan masalah *open-ended* pada materi pola bilangan. Berpikir kreatif adalah kemampuan dalam mengemukakan ide-ide orisinil, sedangkan soal open-ended adalah permasalahan atau soal yang memiliki banyak jawaban yang benar. Indikator kemampuan berpikir kreatif yang digunakan adalah kefasihan, fleksibilitas dan kebaruan. Metode yang digunakan dalam penelitian ini adalah dengan menggunakan metode deskriptif dengan pendekatan kualitatif. Pengumpulan data pada penelitian ini dilakukan dengan cara diberikan tes soal kemampuan berpikir kreatif. Setelah dilakukan tes kemampuan berpikir kreatif, maka dipilih tiga subjek yang memiliki kemampuan berpikir kreatif tinggi, sedang dan rendah untuk dilakukan wawancara. Kemudian hasil wawancara akan dianalisis dengan menggunakan metode triangulasi waktu. Hasil dari penelitian ini diperoleh kesimpulan bahwa pada subjek dengan kemampuan berpikir kreatif kategori tinggi, subjek memenuhi ketiga indikator kefasihan, fleksibilitas dan kebaruan. Pada subjek dengan kemampuan berpikir kreatif kategori sedang, didapatkan subjek hanya memenuhi indikator kefasihan dan fleksibilitas. Sedangkan subjek dengan kemampuan berpikir kreatif kategori rendah didapatkan siswa tidak memenuhi ketiga indikator kemampuan berpikir kreatif.

Kata Kunci**:** *Berpikir kreatif, open-ended, pola bilangan.*

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1. Introduction

The development of technology and information is very rapid in the 21st century. In line with this, education must also be transformed from traditional to modern to ensure that students possess knowledge, learning and innovation skills, the ability to use technology to seek information, and the skills to survive using life skills. 21st-century learning reflects four learning goals (4C), which refer to a part of learning to do, namely Critical Thinking, Creativity, Communication, and Collaboration.

As part of the essential skills needed in the 21st century, creativity is one of the abilities that students at all educational levels must master. Creative thinking is a cognitive process aimed at generating original ideas, emphasizing rational thought, and subsequently used to discover potential solutions to a problem. Molina et al. (2021) explain that creative thinking is the ability to generate new and original ideas. Even individuals who feel incapable of creating new ideas can think creatively if trained. Creative thinking involves the combined use of logic and good intuition. Firdaus & Shodikin (2022) states creative thinking is a mental activity to find ideas, activate imagination, and express new things. Nurjan (2018) explains that creative thinking is a mental activity to develop or discover original, aesthetic, and constructive ideas related to conceptual views, emphasizing both intuitive and rational thinking aspects. Handayani et al. (2019) state that creative thinking is the process of finding many possible solutions to a problem, with emphasizingon the usefulness and diversity of the answers.

Additionally, Saefudin (2012) asserts that creative thinking combines divergent and logical thinking based on intuitive awareness. Munandar (2009) also explains that creative thinking is the ability to see various possible solutions to a problem.

Creative thinking ability is divided into several categories. Siswono (2010) divides creative thinking ability into five levels: 1) Level 4 (very creative), where students can demonstrate fluency, flexibility, and originality or flexibility and originality in solving or posing problems; 2) Level 3 (creative), where students can demonstrate fluency and originality or originality and fluency in solving or posing problems; 3) Level 2 (moderately creative), where students can demonstrate flexibility in solving or posing problems; 4) Level 1 (less creative), where students can demonstrate fluency in solving or posing problems; 5) Level 0 (not creative), where students cannot demonstrate any of the three aspects of creative thinking indicators.

Fardah (2012) divides the categories of students' creative thinking into three parts: high, medium, and low. In the high category, students can understand the given problems and predict the solutions. They then create a plan to solve the problems, implement the plan, and finally evaluate it if there are obstacles to finding the solution. In the medium category, Fardah (2012) explains that students can understand the given problems, predict the solutions, create and implement a plan. However, if they encounter obstacles in executing their plan, they tend to give up easily or even abandon the plan. In the low category, Fardah (2012) states that students have difficulty understanding the given problems and cannot predict the solutions. Even if they create a plan to solve the problems, they do not know whether their plan is correct or not.

Furthermore, Maulana (2017) details each indicator of creative thinking ability. In terms of fluency indicators, a student is considered to have achieved fluency if they can easily generate new ideas to solve a problem, provide examples as answers within a mathematical concept, or offer solutions without significant obstacles. Next, Maulana (2017) explained that a student is considered to have achieved the flexibility indicator if the student can use various methods to solve a problem and explore different perspectives to find a solution. According to the elaboration indicator, Maulana (2017) explains that a student is considered to meet the elaboration indicator if they can solve problems by providing detailed, sequential, and orderly answers according to the procedure. In other words, the student can use mathematical concepts, terms, or symbols correctly. Lastly, a student is said to have achieved the originality indicator if they are able to provide a unique and unconventional solution or use an unusual approach.

In general, creative thinking is a mental activity where a person can generate new ideas from anything in their mind or memory, such as ideas, information, concepts, knowledge, and experiences. Silver (1997) explains that the indicators for assessing students' creative thinking ability include fluency, flexibility, and originality. Meanwhile, Munandar (2009) identifies four indicators of creative thinking ability: fluency, flexibility, elaboration, and originality.

As one of the subjects taught in schools, mathematics also incorporates the process of creative thinking. Ismara et al. (2017) argue that creative thinking ability is closely related to solving mathematical problems. In line with this, Widiyanto & Yunianta (2021) explain that the creative thinking process in mathematics does not always involve finding formulas. For example, if students can illustrate mathematical problems and provide multiple different answers in their own way, they are already using creative thinking in learning mathematics. Siswono (2018) states that the role of mathematics in the learning process is not only to impart educational value that enhances students' intelligence but also to instill educational values that shape students' character, including critical and creative thinking. This aligns with the attachment III of the Ministry of Education and Culture Regulation No. 58 of 2014, which explains that mathematics needs to be taught to all students from elementary school to equip them with the ability to think logically, analytically, systematically, critically, and creatively,

as well as the ability to work collaboratively. From this objective, it is evident that mathematics is essential for developing students' critical and creative thinking skills, which are expected to be useful in learning science and applying mathematics in everyday life.

To measure students' creative thinking abilities, they should be given open-ended problems, allowing them to freely express their ideas according to their understanding, rather than being confined to a single solution process. Everyone has their own style and method for learning mathematics and solving problems. Ritonga et al. (2018) state that open-ended problems are those that have more than one answer or method of solution. Kurniati & Astuti (2016) explain that open-ended problems can be solved using various methods to arrive at the correct answer, and students may even find more than one correct answer. Additionally, Suherman (2003) mentions that open-ended problems are designed to have multiple correct answers. Herdani & Ratu (2018) also state that open-ended problems are problems with many correct answers. According to Ayu et al. (2020), open-ended problems stimulate students' thinking because, with multiple approaches available, students are not confined to a single concept in solving mathematical problems. Instead, they can use various methods, encouragingcreative thinking to solve problems in their own way. By providing open-ended problems, students will not only calculate and answer but also analyze, make conjectures, and explain the problems given (Djahuno, 2016).

One topic in mathematics where open-ended problems can be applied is number patterns. Number patterns are highly suitable for open-ended problems because they offer various benefits in the development of students' creative mathematical skills. Number patterns involve sequences of numbers that form specific patterns, allowing students to explore different types of patterns, such as arithmetic, geometric, or other complex number patterns. The freedom to determine subsequent terms without relying on a specific formula provides flexibility and encourages students' creativity in finding solutions. This process supports the development of analytical and generalization skills, as students need to understand and predict existing patterns. Additionally, open-ended problems involving number patterns contribute to the development of problem-solving skills by requiring students to think critically to identify patterns and formulate appropriate solutions.

Although providing open-ended problems is very effective for enhancing students' creative abilities, especially in mathematics, in reality, research conducted by Fardah (2012) found that only 20% of all students demonstrated high-level creative thinking. Similarly, Handayani et al. (2019) stated that only 15% of all students had very creative abilities, and 35% of students had creative abilities.

Based on the explanations above, the researcher is interested in conducting a study titled: "Profile of Junior High School Students' Creative Thinking Abilities in Solving Open-Ended Problems on Number Patterns". The profile of creative thinking skills is chosen as the focus of this research because the researcher believes that a description of students' creative thinking abilities is needed, which can later be used by teachers to help further enhance students' creative thinking skills. Number patterns are selected because they require some interpretation of the patterns that will be applied, making it easier to assess the level of creative ability of the students who will be the subjects of the study. The subjects of this research are 8^{th}-grade students at SMPN 8 Pamekasan, as initial observations by the researcher revealed that some students exhibited creative abilities. Therefore, it is necessary to describe the level of creative ability of these students. This study aims to describe the creative thinking processes of students, with the hope of assisting teachers in improving the quality of mathematics education in schools.

This research is supported by several previous studies, namely those of Ayu et al (2020), Handayani et al. (2019), Herdani & Ratu (2018), Mursidik et al. (2015), and Putri &

Wijayanti (2013). The difference between this research and previous studies lies in its exclusive focus on students' creative thinking skills, without considering other factors such as motivation, mathematical ability, learning styles, and so on. Additionally, this research differs from previous studies in terms of the creative thinking skills test material. Previous studies focused solely on geometry test questions, while in this research, the questions provided are related to number patterns.

2. Methods

The chosen research location for this study is SMPN 8 Pamekasan. The type of research is descriptive research, as the purpose of this study is to describe the creative thinking abilities of junior high school students. This is in line with what Arikunto (2013) stated, that descriptive research aims to investigate conditions, situations, or other matters, the results of which will be presented as a research report. The chosen approach is qualitative. Sugiyono (2013) revealed that the qualitative research method is used to examine natural object conditions, where the researcher serves as the key instrument, data collection techniques are conducted through triangulation (combination), data analysis is inductive/qualitative, and qualitative research results emphasize meaning rather than generalization.

In this research, the indicators used are fluency, flexibility, and originality, and these three indicators are often used to measure creative thinking abilities (Alabbasi et al., 2022). The data to be used in this study are the results of a test of students' creative thinking abilities. Meanwhile, the data source in this study is students in class VIIIA of SMPN 8 Pamekasan, from which one student with a high creative thinking category, one with a moderate creative thinking category, and one with a low creative thinking category will be selected after all students are given open-ended problems.

The techniques used in this study consist of two types: a test of creative thinking ability and an interview test. After the data is collected and subjects with high, moderate, and low creative thinking abilities are identified, data analysis techniques will be conducted, including data classification, data reduction, data presentation, and concluding. To ensure the validity of the obtained data, a data validity technique called time triangulation is used, which involves checking the validity of the data using the same subjects and techniques but at different times (Alfansyur & Mariyani, 2020).

In this study, the students will be given three problems related to number patterns, each of which represents one indicator of creative thinking skills. The problems that will be given to the students can be seen in Table 1.

Table 1. Creative Thinking Skills Problems

Number	Problem	Indicator
1	Rizqy was given a task by her teacher to create several number patterns. Help Rizqy write some examples of number patterns and then help her identify which type of sequence the created patterns belong to!	Fluency
2	Given the numbers $1,2,2\sqrt{2},3,4,5,9,10,25$	
2a	Create several number sequences with the condition that two of the numbers are taken from the given numbers!	Flexibility
2b	From the sequences obtained in point a, try to arrange those sequences in such a way that they form a new sequence!	Originality

After the students have answered the test questions given, the next step is to analyze and score their responses. The scoring guidelines for the creative thinking ability test are based on the rubric developed by Bosch (1997), with slight modifications as seen in the following Table 2.

Table 2. Scoring Guidelines for Creative Thinking Ability Test

Indicators	Responses to the problem	Score
Fluency	Not providing an answer or providing ideas that are irrelevant to the problem.	0
	Providing an idea that is irrelevant to solving the problem.	1
	Providing a relevant idea but the result is incorrect.	2
	Providing more than one relevant idea but the result is still incorrect.	3
	Providing more than one relevant idea and the solution is correct and clear.	4
Flexibility	Not providing an answer or providing answers using one or more methods but all results are incorrect.	0
	Providing an answer using only one method but giving an incorrect answer.	1
	Providing an answer using one method, the calculation process, and the result are correct.	2
	Providing more than one answer but some are incorrect due to errors in the calculation process.	3
	Providing answers using more than one method, the calculation process, and the answers are correct.	4
Originality	Not providing an answer or providing an incorrect answer.	0
	Providing an answer in their own way but it cannot be understood.	1
	Providing an answer in their own way, the calculation process is directed but not completed.	2
	Providing an answer in their own way but there are errors in the calculation process, resulting in an incorrect answer.	3
	Providing an answer in their own way, the calculation process, and the answer are correct.	4

Source : Moma (2015)

After all the students' test answers have been scored based on Table 2, the next step is to group the students into several categories of creative thinking ability: high, medium, and low. The assessment guidelines used in this study are based on the scoring guidelines by Herdani & Ratu (2018), which have been previously reclassified and can be seen in the following Table 3.

Table 3. Scoring Boundary Guidelines for Categories of Creative Thinking Ability

Score	Category
9-12	High
5-8	Medium
0-4	Low

After conducting the creative thinking skills test and performing the grouping, the next step is to conduct the interview tests. The purpose of the interview is to understand the reasons behind the subjects' answers to the test questions. The results of the interview, which are in the form of qualitative data, are verified for validity and then analyzed using Miles and

Huberman's analysis techniques. First, data reduction involves classifying information and discarding raw data collected from the field regarding the level of students' creative thinking skills in solving the given problems. Second, data presentation includes activities of classifying and describing students' creative thinking abilities based on three main criteria of creative thinking: fluency, flexibility, and originality. Finally, drawing conclusions or verification is done to describe the level of creative thinking ability in each group based on the data presentation. Each selected subject must meet all the indicators to be considered as having fulfilled the measured skills. The indicators measured in the interviews are listed in Table 4 below.

Table 4. Indicators of Creative Thinking Skills in Number Patterns Material

Measured Skills	Indicators
Fluency	Arranging number patterns correctly and without any obstacles.
	Accurately explaining the number patterns that have been created.
Flexibility	Arranging number patterns with several different patterns.
	Accurately explaining how to derive the number patterns that have been created.
Originality	Arranging new number patterns that are neither arithmetic nor geometric sequences.
	Providing an unconventional explanation for the answer given in the previous point.

3. Results and Discussion

The selection of the subject is based on the guidelines explained in the methods section. The prospective subjects of the study are 8th-grade students from SMP Negeri 8 Pamekasan, which consists of 6 classes: VIIIA, VIIIB, VIIIC, VIIID, VIIIE, and VIIIF. Based on suggestions and information from the mathematics teacher, class VIIIA, consisting of 28 students, was selected to be given the first creative thinking skills test.

After selecting the class, three creative thinking skills test questions were given to the students in class VIIIA. After that, the students' answers were scored based on the guidelines in Table 2 and Table 3. Subsequently, the scores were categorized and grouped into three levels: low, medium, and high. After the grouping, the following data were obtained.

Table 5. Results of Students' Creative Thinking Ability Test

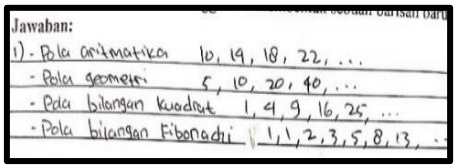
No.	Student Code	Fluency	Flexibility	Originality	Total Score	Category
1	AY	4	2	0	6	Medium
2	AS	4	3	4	11	High
3	AJP	1	2	0	3	Low
4	A	4	4	3	11	High
5	CAS	4	4	3	11	High
6	DRC	4	3	0	7	Medium
7	YAR	2	1	0	3	Low
8	DI	4	3	4	11	High
9	EAA	4	4	3	11	High
10	FHAS	4	4	3	11	High

No.	Student Code	Fluency	Flexibility	Originality	Total Score	Category
11	INAA	2	1	3	6	Medium
12	JBS	4	2	0	6	Medium
13	KPM	4	1	3	8	Medium
14	MJHM	4	4	3	11	High
15	MRP	2	4	0	6	Medium
16	MRT	2	2	0	4	Low
17	MDA	1	2	3	6	Medium
18	NUN	2	1	0	3	Low
19	NTJS	4	4	4	12	High
20	NBA	2	4	0	6	Medium
21	PAS	4	4	4	12	High
22	RA	2	3	0	5	Medium
23	SM	4	4	3	11	High
24	SIW	4	2	3	9	High
25	SAH	4	3	4	11	High
26	SMAF	2	2	4	8	Medium
27	SA	2	1	3	6	Medium
28	YAR	4	0	0	4	Low

After the grouping process and based on the suggestion from the mathematics teacher, three subjects were selected for further interviews. The chosen subjects are NTJS representing the high category, DRC representing the medium category, and YAR representing the low category.

3.2.1 Subject with High Creative Thinking Ability

The subject with high creative thinking ability, namely NTJS, scored 4 on question number 1, 4 on question number 2a, and obtained a score of 4 on question number 2b. Thus, the total overall score obtained by subject NTJS is 12, placing him in the high creative thinking category.



The subject wrote arithmetic, geometric, quadratic, and Fibonacci number patterns to answer question number 1

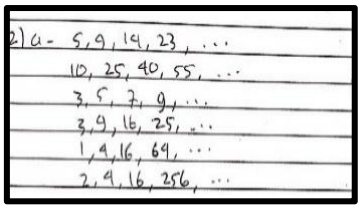
Picture 1. Answer to question number 1 for Subject with High Creative Thinking Ability

In question number 1, which is designed to measure fluency level, subject NTJS was able to provide several different ideas in answering the question. It is evident that subject NTJS provided 4 different ideas, all of which were correct in steps and answers. Thus, in question number 1, subject NTJS obtained a score of 4. Additionally, subject NTJS could also explain the given answers fluently.

To verify the answers from the subject, it is necessary to conduct an interview regarding their results. The following interview results are presented to represent the stage of solving questions from the researcher to subject NTJS. Questions from the researcher are coded R, and the subject's answers are coded NTJS.

R : "What do you understand from this question?"
NTJS : "In that question, I was asked to create several sequences. After creating these sequences, I was required to identify which type of sequence they belong to."
R: "After that, what steps did you take to solve question number 1?"
NTJS : "Okay ka. For the first sequence, I used an arithmetic pattern. An arithmetic sequence has a constant difference. So, I took the first term as 10, and the common difference as 4. Therefore, the next term is 10 plus 4, which is 14; then 14 plus 4, which is 18; and 18 plus 4, which is 22."
R : "Okay, that's correct according to the arithmetic concept used. Next, how did you obtain the pattern for the second sequence?"
NTJS : "For the second sequence, I used a geometric pattern. In a geometric sequence, each term is multiplied by the same number. So, I took the first term as 5, and then multiplied the subsequent numbers by 2. Thus, 5 multiplied by 2 equals 10. Then 10 multiplied by 2 equals 20, and 20 multiplied by 2 equals 40, and so on."
R : "Okay, that's correct. What's next?"
NTJS : "Next is the square numbers sequence kak. A square number means a number squared. So, I started with 1 squared, which is 1. The next number is 2 squared, which is 4. Then, 3 squared is 9, and so on."
R : "For the last sequence, how did you obtain it?"
NTJS : "For the last sequence, I used the Fibonacci sequence. I started with the first and second numbers as 1. Then, for the subsequent numbers, I added the two preceding numbers. So, 1 plus 1 equals 2. Then, 2 plus 1 equals 3. Next, 2 plus 3 equals 5, and so on, continuing this process kak."

From the answers and interview excerpts from subject NTJS in response to question number 1, it was found that the subject NTJS understands the intent of the given problems and can express ideas by correctly writing several number patterns. Additionally, the subject NTJS can also correctly identify several number patterns that have been written without any difficulty. This indicates that the NTJS subject meets the fluency indicator in creative thinking skills.



The subject can form several different number patterns with one unique number pattern.

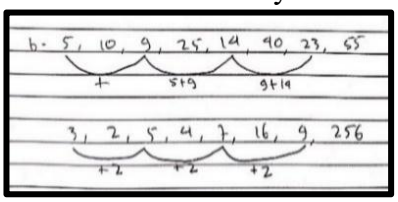
Picture 2. Answer to question number 2a for Subject with High Creative Thinking Ability

Here is the interview with subject NTJS to support the results of his test answers.

R : "Please read the question number 2a again!"
NTJS : "Given the numbers $1,2,2\sqrt{2},3,4,5,9,10,25$*, The task for question 2a is to Create several number sequences with the condition that two of the numbers are taken from the given numbers!"*
R : "Okay. Now, please identify the types of sequences you have written."

NTJS : " For the first sequence, it is a Fibonacci sequence. The second and third sequences are arithmetic sequences. The fourth sequence is a square number sequence. The fifth sequence is a geometric sequence. The last one, I am not sure what it is called because it does not fit into the sequences I have studied."
R : "Okay, I understand. Now, I am interested in this sequence (while pointing to the last sequence). Could you explain where you got this sequence from?"
NTJS : "Alright kak. I created it like this: first, I started with the number 2. For the next term, I squared 2, which results in 4. Then, I squared 4, giving 16. After that, I squared 16 to get 256, and so on."
R : "That's quite an interesting sequence. How did you come up with the idea to create such a sequence? What led you to think of making something like this?"
NTJS : "I am not sure, actually. I initially took the numbers 2 and 4 from the question. Then I realized that 4 is the square of 2, so I thought to continue squaring the numbers from there."

From the answers and interview excerpts on question number 2a, which is designed to measure the level of flexibility, subject NTJS was able to provide several different methods in answering the question. It is evident that subject NTJS provided 6 different methods, all of which were correctly written in steps and execution. Additionally, in the last sequence, which is 2,4,16,256,..., it is a unique method provided by subject NTJS. Thus, based on the answer to question 2a, subject NTJS obtained a score of 4. From this, it can be concluded that subject NTJS fulfills the flexibility indicator.



The subject can combine several number patterns into a new number pattern.

Picture 3. Answer to question number 2b for Subject with High Creative Thinking Ability

Here is the interview with subject NTJS to support the results of the answers to question number 2b.
R : "From that question, what can you understand?"
NTJS : "I was asked to create sequences based on the sequences I made in question number 2a kak."
R : "This is your answer (while pointing to the subject's answer). Could you explain about this sequence?"
NTJS : "So, for the sequence I created, I tried to combine the sequences from question 2a, specifically the sequences from number 1 and number 2. I alternated between the two sequences, taking the first number from the first sequence, the second number from the second sequence, and so on."
R : "Oh, I see. Take a look at the first sequence you created (while pointing to the first sequence in the answer to 2b). Do you think this sequence forms a new sequence?"
NTJS : "Yes, kak."
R : "What is the reason?"
NTJS : "The reason is that since I created the sequence by alternating, it means there are odd and even terms. So, I placed the first number as 5 and the third number as 9. For the subsequent odd terms, I just added the two previous odd terms."

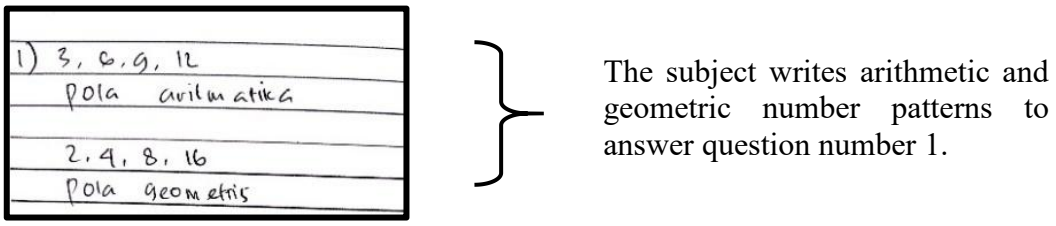
From the answers and interview excerpts on question number 2b, which is designed to measure the level of originality, subject NTJS was able to provide an answer in his own way.

Subject NTJS created several new sequences by combining two sequences from question 2a. Additionally, subject NTJS created a new sequence with a unique number pattern. Thus, based on the answer to question 2b, subject NTJS obtained a score of 4. From this, it can be concluded that the subject NTJS fulfills the originality indicator.

Thus, based on these three aspects, it can be concluded that subject NTJS, with high creative thinking ability, meets all three indicators: fluency, flexibility, and originality. This finding aligns with the research conducted by Handayani et al. (2019) and Putri & Wijayanti (2013), which states that students with highly creative thinking ability (categorized as high in this study) fulfill the indicators of fluency, flexibility, and originality. This is also in line with the research results of Wulandari et al. (2024) which showed that students with high logical abilities were able to generate many alternative answers that were not considered by other students and their problem-solving abilities were also better.

3.2.2 Subject with Medium Creative Thinking Ability

The subject with medium creative thinking ability, DRC, scored 4 on question number 1, 3 on question number 2a, and 0 on question number 2b. Thus, the total overall score obtained by subject DRC is 7, placing her in the medium creative thinking category.



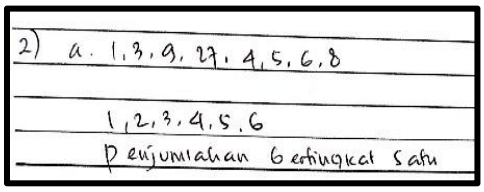
Picture 4. Answer to question number 1 for Subject with Medium Creative Thinking Ability

In question number 1, the subject DRC obtained a score of 4. To verify the answers from the subject, it is necessary to conduct an interview regarding their results. The following interview results are presented to represent the stage of solving questions from the researcher to subject DRC. Questions from the researcher are coded R, and the subject's answers are coded DRC.

R : "What can you understand from the intent of the problem?"
DRC : "In my opinion kak, from the problem, I am asked to create several sequences. Then, I am asked to determine which types of sequences I have created."
R : "After understanding the problem, what are your next steps in solving question number 1?"
DRC : "For the first sequence, I chose an arithmetic sequence. In an arithmetic sequence, each term is obtained by adding a constant value. First, I chose the first term to be 3. Then, I added 3 to each subsequent term. Therefore, the first sequence is 3, 6, 9, 12."
R : "What about the second sequence?"
DRC : "For the second sequence, I chose a geometric sequence, kak."
R : "What are the characteristics of a geometric sequence?"
DRC : "Multiplied by the same number"
R : "Yes, that's correct. So, how do you obtain the second sequence?"
DRC : "I multiplied by 2. Therefore, I wrote 2, 4, 8, 16*."*

From the responses and interview excerpts from DRC in answering question number 1, which is intended to measure the fluency level of the subject DRC, it can be seen that DRC is able to provide ideas relevant to the question and create two number patterns correctly and without encountering any obstacles. Additionally, the subject can accurately explain the

sequences they have created. From this, it can be concluded that subject DRC fulfills the fluency indicator.

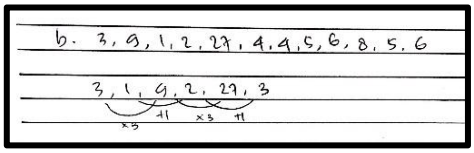


The subject cannot correctly form several number patterns from the given numbers.

Picture 5. Answer to question number 2a for Subject with Medium Creative Thinking Ability

Based on the answer to question 2a, subject DRC obtained a score of 3. Here is the interview with subject DRC to support the results of her test answers.
R : "What can you understand from the problem?"
DRC : "I am asked to create several number sequences. The requirement is to use two numbers from the problem."
R : "How do you plan to solve question number 2a?"
DRC : "First, I took two numbers from the problem as instructed. Then, I created several number sequences from those two numbers that I am familiar with, kak."
R : "Oh, I see. Now, let's take a look at this answer of yours. I'm actually quite interested in this particular answer (while pointing to the sequence in question). Could you explain this sequence?"
DRC : "For the first sequence, I used the numbers 1 and 3 from the problem. Then, I formed a geometric sequence. So, 3 is 1 multiplied by 3. Next, I multiplied 9 by 3, which gives 27. And so on for the subsequent terms."
R : "Okay. You mentioned that the sequence uses a geometric progression, right? Now, let's examine the fifth term of this sequence. Do you think it forms a geometric sequence?"
DRC : "Eeee, I think, no"
R : "In that case, it is not a geometric sequence. What should come after the number 27?"
DRC : "It was multiplied by 3, so the next number should be 81."

From the responses and interview excerpts from the subject DRC in answering question number 2a, which is designed to measure the level of flexibility, subject DRC was able to provide more than one different method in answering the question. It is evident that subject DRC provided 2 different methods. However, there were calculation errors in question number 2a, resulting in incorrect answers, because one of the number patterns created does not form a correct pattern. Furthermore, in the correct answer to question 2a, DRC can accurately explain the process of obtaining that result. From this, it can be concluded that subject DRC fulfills the flexibility indicator.



The subject cannot correctly form a new number patterns.

Picture 6. Answer to question number 2b for Subject with Medium Creative Thinking Ability

Based on the answer to question 2b, subject DRC obtained a score of 0. Here is the interview with subject DRC to support the results of the answers to question number 2b.
R : "What do you understand from the problem?"

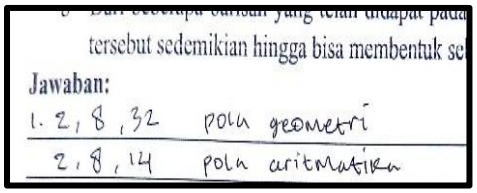
DRC : "I am asked to create a new sequence based on the answer to question 2a."
R : "Now, could you explain the sequence you created?"
DRC : "For the first sequence, I took the first two numbers from the first sequence in answer 2a, and then I took two numbers from the second sequence in 2a, and so on."
R : "What about the second sequence?"
DRC : "For the second sequence, I alternated the terms. I took the first term from the first sequence in my answer to question 2a, and the second term from the second sequence in question 2a. And so on."
R : "Why did you think of creating a sequence like that?"
DRC : "I am not sure either. I am just trying to combine the sequences."

From the responses and interview excerpts from the subject DRC in answering question number 2b, which is designed to measure the level of originality, subject DRC was able to provide an answer in their own way. However, DRC's answer was incomprehensible regarding the type of number pattern formed. Additionally, The subject DRC only combined the two sequences obtained from the previous problem, without considering whether the new number pattern created follows a correct pattern or not. This was validated during the interview when subject DRC could not explain the number pattern they had created. From this, it can be concluded that subject DRC does not fulfill the originality indicator.

Based on these three aspects, it can be concluded that subject DRC, with medium creative thinking ability, meets two indicators: fluency and flexibility. This finding slightly differs from the study by Handayani et al. (2019), which stated that students with moderately creative thinking abilities (categorized as medium in this study) all met the flexibility indicator. Nevertheless, the findings from this study are supported by the findings of Herdani & Ratu (2018) and Mursidik et al. (2015), which indicate that students with moderately creative thinking abilities (categorized as medium in this study) meet the fluency and flexibility indicators. This is evident from students with moderately creative thinking abilities, who each scored 4 for fluency and 5 for flexibility. However, for the originality indicator, these students only scored 1, indicating they do not meet the originality indicator.

3.2.3 Subject with Low Creative Thinking Ability

The subject with low creative thinking ability, YAR, scored 4 on question 1, 0 on question 2a, and 0 on question 2b. Thus, the total score obtained by the subject YAR is 4, placing him in the low creative thinking category.



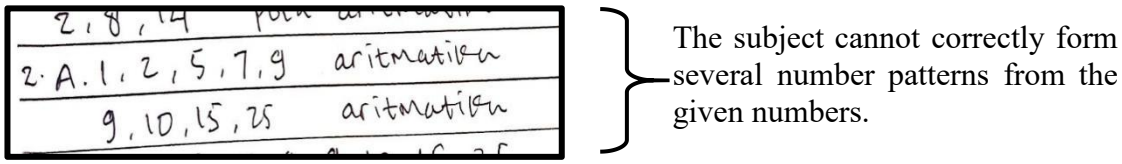
The subject wrote arithmetic and geometric number patterns to answer question number 1.

Picture 7. Answer to question number 1 for Subject with Low Creative Thinking Ability

For question number 1, the subject YAR scored 4. To verify the answers from the subject, it is necessary to conduct an interview regarding their results. The following interview results are presented to represent the stage of solving questions from the researcher to subject YAR. Questions from the researcher are coded R, and the subject's answers are coded YAR.
R : "What can you understand from question number 1?"
YAR : "I am asked to create several sequence, kak."

R : "What did you do next while working on the problem?"
YAR : "I am trying to recall the lessons from the teacher, kak."
R : "Please explain the sequence you have created."
YAR : "The number patterns that I created are geometric and arithmetic sequences."
R : "For the geometric sequence, what is the ratio or the number by which each term is multiplied?"
YAR : "I do not know. I have forgotten."

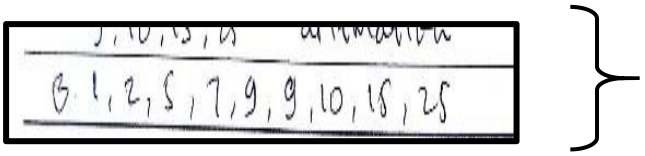
From the responses and interview excerpts from the subject YAR in answering question number 1, designed to measure the level of fluency, the subject YAR was able to provide several different ideas in answering the question. It is evident that the subject YAR provided 2 different ideas, all of which were correct in terms of steps and answers. However, the subject YAR was unable to explain the given answers. This is supported by the results of the interview conducted with YAR, who was found not to know the ratio of the geometric sequence that was created. This may have happened because YAR either wrote randomly or copied the work of a classmate without verifying whether the answers were correct. Therefore, the subject YAR did not meet the fluency indicator.



Picture 8. Answer to question number 2a for Subject with Low Creative Thinking Ability

Based on these answers, the subject YAR was given a score of 0 for question number 2a. Here is the interview with subject YAR to support the results of his test answers.
R : "What do you understand from question 2a?"
YAR : "According to the problem, I am asked to create sequences."
R : "What are the requirements?"
YAR : "Choose 2 numbers from the problem, kak."
R : "Yes, that's correct. Now let's look at your answer. You wrote that the sequence you provided is an arithmetic sequence, but why doesn't it form an arithmetic pattern?"
YAR : "Actually, I just wrote that answer without much thought because I still don't fully understand and have forgotten some material about sequences."

From the responses and interview excerpts from the subject YAR in answering question number 2a, which is designed to measure the level of flexibility, the subject YAR only provided one method in answering the question. However, in all the answers given by the subject YAR, the steps and answers were all incorrect. Additionally, the interview results also reveal that YAR merely writes answers without knowing whether they are correct or not. This is because YAR does not fully understand the material on number patterns. This also reinforces the reason why YAR in question number 1 cannot explain the answers they have written. Consequently, the subject YAR did not meet the flexibility indicator.



The subject cannot correctly form a new number patterns.

Picture 9. Answer to question number 2b for Subject with Low Creative Thinking Ability

Based on the answer to question 2b, subject YAR scored 0. Here is the interview with subject DRC to support the results of the answers to question number 2b.
R : "What can you understand from the problem?"
YAR : "Construct a new sequence from the answer to question 2a."
R : "Where did you get the sequence you created?"
YAR : "As I recall, when I was working on the problem, I only combined the sequences in question 2a."
R : "Oh, I see. But does the sequence you created form a pattern?"
YAR : "I do not know, kak."

From the responses and interview excerpts from the subject YAR in answering question number 2a, designed to measure the level of originality, the subject YAR was able to provide an answer in their own way. However, the answer provided by subject YAR could not be understood in terms of what number pattern it formed. This was validated during the interview with subject YAR, who could not understand the question or the number pattern created. Consequently, subject YAR did not meet the originality indicator.

Therefore, based on these three points, it can be inferred that the subject YAR, with low creative thinking abilities, does not meet all three indicators of creative thinking skills. This aligns with the research findings by Ayu et al. (2020), stating that students categorized as not creative (classified here as the low category) do not fulfill any indicators of creative thinking skills. Furthermore, the findings from this study are also supported by research results from Herdani & Ratu (2018) and Putri & Wijayanti (2013) on students with non-creative thinking abilities (classified here as low category), where these students, although they could understand the questions based on the fluency indicator, completely failed to meet the flexibility and originality indicators by providing incorrect answers.

Based on the results and discussion of this study, several similarities and differences with previous research were found. These similarities and differences are presented in **Table 6** below.

Table 6. Position of The Research Results Relative To Previous Studies

Research Findings	Level of Creative Thinking Ability	Achieved Indicators		
		Fluency	Flexibility	Originality
This study	High	✓	✓	✓
	Medium	✓	×	×
	Low	×	×	×
Handayani et al. (2019)	High	✓	✓	✓
	Medium	×	✓	×
	Low	×	×	×
Putri & Wijayanti (2013)	High	✓	✓	✓
	Medium	✓	×	✓
	Low	×	×	×
Herdani & Ratu (2018)	High	✓	✓	×
	Medium	✓	×	×
	Low	×	×	×
Mursidik et al. (2015)	High	✓	✓	×
	Medium	✓	×	×
	Low	×	×	×

Research Findings	Level of Creative Thinking Ability	Achieved Indicators		
		Fluency	Flexibility	Originality
Ayu et al. (2020)	High	✓	✓	×
	Medium	×	✓	×
	Low	×	×	×

4. Conclusion

Creative thinking skills are essential abilities that students must master to compete in this era of rapid development, especially in the 21st century. There are three indicators used to assess creative thinking skills: fluency, flexibility, and originality. Based on the analysis and discussion above, it can be seen that the three selected subjects have different ways of thinking and levels of creative thinking abilities. In the subject with high creative thinking abilities, it was found that the subject fulfilled all three indicators. In contrast to the subject with high creative thinking abilities, the subject with moderate creative thinking abilities only fulfilled the fluency and flexibility indicators, while the subject with low creative thinking abilities did not fulfill all three indicators. The results of this study are expected to contribute to the development of a more innovative curriculum that focuses on enhancing creative thinking skills, which will prepare students to face the challenges of the 21st century.

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