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Designing Number Pattern Questions to Assess Students with Kinesthetic Learning Styles' in Mathematical Thinking

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ABSTRACT

The aim of the research is to describe the results of designing number pattern questions used to measure the mathematical thinking abilities of students with a kinesthetic learning style. The research subjects consisted of 5 class VIII students with a kinesthetic learning style. The type of research is design research with 5 stages, namely: Preliminary Design, Focus Group Discussion (FGD), Trial, Interview, and Retrospective Analysis. The data collection techniques are learning style questionnaires, tests and interviews. The data analysis used in the research is qualitative. Based on the results of the FGD, number pattern questions can be used to measure mathematical thinking abilities, because each question leads students to bring up specializing, generalizing, conjecturing and convincing aspects. Based on the test results, it is known that students can write specializing, generalizing, conjecturing, and convincing forms. Specializing is seen when students write the form of adding numbers for each term. Generalizing is seen when students find patterns by listing them one by one or using tables, conjecturing when they find the general formula, and convincing is seen when they find other ways to prove the answer. Based on the results of the interview, students' answers were obtained through the activity of managing and simulating questions using body parts.

ABSTRACT

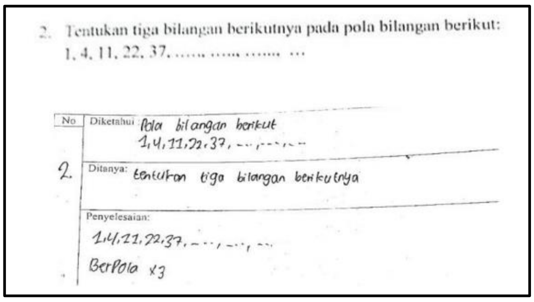
Tujuan penelitian yaitu mendeskripsikan hasil mendesain soal pola bilangan yang digunakan untuk mengukur kemampuan berpikir matematis siswa dengan gaya belajar kinestetik. Subjek penelitian terdiri dari 5 siswa kelas VIII dengan gaya belajar kinestetik. Jenis penelitian yaitu design research dengan 5 tahapan yaitu: Preliminary Design, Focus Group Discussion (FGD), Trial, Interview, dan Retrospective Analysis. Teknik pengumpulan datanya yaitu angket gaya belajar, tes dan wawancara. Analisis data yang digunakan dalam penelitian adalah kualitatif. Berdasarkan hasil FGD, soal pola bilangan sudah dapat digunakan untuk mengukur kemampuan berpikir matematis, karena setiap pertanyaan menggiring siswa untuk memunculkan aspek specializing, generalizing, conjecturing, dan convincing. Berdasarkan hasil uji coba diketahui bahwa siswa dapat menuliskan bentuk specializing, generalizing, conjecturing, dan convincing. Specializing terlihat ketika siswa menuliskan bentuk penjumlahan bilangan untuk setiap sukunya. Generalizing terlihat ketika siswa menemukan pola dengan cara mendaftarkan satu persatu maupun menggunakan tabel, conjecturing saat menemukan rumus umumnya, serta convincing terlihat saat menemukan cara lain untuk membuktikan jawabannya. Berdasarkan hasil wawancara, jawaban siswa diperoleh melalui aktivitas menurus dan mensimulasikan soal dengan menggunakan anggota tubuh.

INTRODUCTION

Mathematics is a lesson that can train students' thinking processes systematically and logically (Herlina & Ihsan, 2020). In mathematics, students' thinking processes are called mathematical thinking. According to Jawad et al., (2021) the ability to think mathematically is a very important skill in learning mathematics. Not only in learning, mathematical thinking is also useful in everyday life, because mathematical thinking requires many skills such as logical and analytical thinking and quantitative reasoning (Susanti et al., 2019). The ability to think mathematically is an important ability that students need to master when learning mathematics, because in learning mathematics there is a process of solving mathematical problems, the process includes students' ability to understand concepts, develop strategies and solve problems, as well as evaluate the results of problem solving (Munawaroh, 2021). Therefore, mathematical thinking skills need to be developed and improved.

According to Delima, Rahmah, and Akbar (2018), the ability to think mathematically has four characteristics, namely specializing, generalizing, conjecturing and convincing. Specializing shown when students solve various problems by looking at examples. Generalizing shown when students see a patterns and its relationships to emerge for solving problem. Conjecturing shown when students predict relationships and results from generalizing. Convincing shown when students discover and communicate reasons why something is true (Lestari et al., 2022). However, in reality, according to Sari et al., (2021) explained that students' mathematical thinking abilities were in the sufficient category because some students had difficulty understanding problem and its steps in solving problems. Also, the research results of Rosidi et al., (2022) show that the ability to think and reason mathematically for each student is different due to differences in absorbing and processing information. Differences in mathematical thinking abilities are closely related to students' way of thinking in capturing information and solving problems (Wilujeng & Sudihartinih, 2021). This way of thinking is called learning style, each student has a unique way of solving mathematical problems because each student's learning style will be different (Ramadhana et al., 2022).

There are three types of learning styles, namely visual, auditory and kinesthetic. According to Nurdiana et al. (2021) students who have a kinesthetic learning style have less ability in working on math story problems. Aurelia et al., (2022) also said that students with a kinesthetic learning style prefer direct practice and working on questions in front of the class so that students' ability to plan solutions and check again is very low. In the number pattern problem, students with a kinesthetic learning style received the lowest assessment percentage, namely 39%, because students had not been able to determine a strategy to solve the problem correctly. Figure 1 is an example of a kinesthetic learning style student's answer to number pattern material (Inastuti et al., 2021)


2. Tentukan tiga bilangan berikutnya pada pola bilangan berikut:
1, 4, 11, 22, 37, ...

No	
	Diketahui: Pola bilangan berikut 1,4,11,22,37, ...,...,...
2	Ditanya: tentukan tiga bilangan berikutnya
	Penyelesaian: 1,4,11,22,37, ...,...,... Berpola x3

(A) Original Answer

2. Determine the next three numbers in the following number pattern
1,4,11,22,37, ... , ..., ..., ...

No	Information : the following number pattern 1,4,11,22,37, ... , ..., ...
2	Asked : Determine the next three numbers
	Solution : 1,4,11,22,37, ... , ..., ... Patterned × 3

(B) Translation

Figure 1. Answers from kinesthetic learning style students

On Figure 1 shows that students have not shown the characteristics of the mathematical thinking process. The reason why students with a kinesthetic learning style have not demonstrated mathematical thinking processes, because they prefer direct practice in solving problem so they cannot make generalizing patterns (Inastuti et al., 2021). Teachers should facilitate students to learn according to their interests and learning styles. According to Solomon et al., (2023) there is an astonishing increase in students' problem solving with a kinesthetic learning style if educators provide manipulative objects to explain the problem so that students can hold and calculate for themselves and educators help simplify the problem to make it easier for students to understand the problem. Along with this, there are also problems in solving problems that are not in accordance with the kinesthetic learning style. So far, existing number pattern questions have been used for all learning styles. So it is necessary to innovate in designing number pattern questions that suit the characteristics of the kinesthetic learning style. The number pattern questions that will be designed direct students to carry out kinesthetic activities in solving problems, such as simulating questions with their body parts to prove the answer is correct, as well as carrying out activities of arranging or arranging stick pieces to get the pattern for each term. Based on the description above, researchers are interested in conducting research with the title "Design of Number Pattern Questions to Measure the Mathematical Thinking Ability of Kinesthetic Learning Style Students ".

METHOD

This type of research is design research, which consists of five stages, namely initial design, *Focus Group Discussion* (FGD), Test, Interview, and Retrospective Analysis (Susanti et al., 2021).

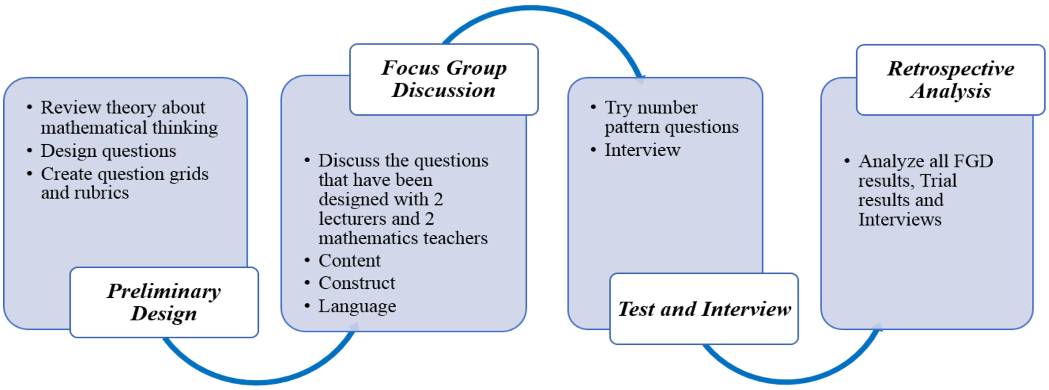


Figure 2. Research Design

Based on the chart above, the stages carried out in designing this question are:

1. Preliminary Design
   This stage is carried out at the beginning of the research, with reviewing theories about mathematical thinking by reading references from relevant sources. Then, the researcher created a research instrument in the form of number pattern questions.
2. Focus Group Discussion
   After the researchers created number pattern questions, the researchers conducted a focus group discussion with two mathematics lecturers and two mathematics teachers. Aspects discussed in the focus group discussion include content, constructs and language.
3. Test And Interview
   Test is given to students with 3 essay questions. The essay question was chosen because the essay question included a description of the student's answer or the student's steps in solving the problem so that researchers could know the student's process in finding the answer. This data is needed to be explained at the data analysis stage. The interview was carried out after the data analysis test was completed. The purpose of the interview is to gather in-depth information about how students solve problems and the relationship between these questions and students' learning styles (Sartika et al., 2022).
4. Retrospective Analysis
   The final stage of this research is retrospective analysis, where at this stage all findings will be analyzed from the results of focus group discussions (FGD), test results and interviews. The results of the retrospective analysis will be used to improve the number pattern questions that have been designed.

Subject

The research subjects initially consisted of 30 junior high school students These students were instructed to fill out a learning style questionnaire. The questionnaire consist of 24 questions. Based on result of questionnaire, the researchers found 10 students with a kinesthetic learning style. However, this research only took 5 students with a kinesthetic learning style, because the 5 students selected as research subjects were based on the recommendation of the supervising teacher.

Data Collection

The data collection techniques used in this research were learning style questionnaires, tests and interviews.

1. The questionnaire used in this research is a learning styles questionnaire which has been adapted to the definition of learning styles and adapted from Afdilah et al., (2021) which contains 24 questions. This questionnaire is given to students before answering test questions. The results of the questionnaire are used as a reference to determine the type of student learning style. The form of questions in the questionnaire used is closed, where students answer by choosing one answer for each question provided.
2. Test.
   The test question in this research is in the form of a essay. The purpose of giving the test is to determine student mathematical thinking ability.
3. Interview.

The type of interview conducted by the researcher is a semi-structured interview where the researcher will only ask certain questions. Interviews are used to dig deeper into students' mathematical thinking processes in solving test questions. The interview took place by asking questions to the informant directly. The questions asked during the interview can be used as a reference for researchers to complete data that is not yet known through test results.

Data Analysis

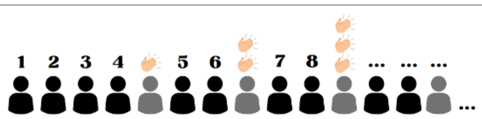
To analyze the results of the student learning style questionnaire, the researcher will first correct the results of filling out the student's questionnaire and then see the suitability of the type of learning style that matches the results of each student's questionnaire. Researchers will summarize the characteristic indicators of each type of learning style, namely audio, visual and kinesthetic. The results of the student questionnaire will be corrected and the highest learning style indicators will be looked at to determine the student's learning style. Next, the test and interview data will be analyzed qualitatively by describing each indicator of students' mathematical thinking abilities with a kinesthetic learning style.

RESULTS AND DISCUSSION

3.1 Preliminary design

In the initial design stage, researchers look for some theories about mathematical thinking. From theory there are four indicators in mathematical thinking, there are specialization, generalization, conjecture, and convincing (Tohir et al., 2020). From exploring and understanding theoretical studies, there are several number pattern questions that can be used to measure junior high school students' mathematical thinking abilities. These questions were adopted from journals regarding mathematical thinking abilities. Then the questions are selected and changed to suit the abilities of high school students. Initially the questions were not suitable for kinesthetic students, but then they were modified for kinesthetic students. The table 1 is 3 questions used in this research:

Table 1. Questions used in this research

No	Questions	Explanation
1	What is the sum of the first 200 even numbers!	Question design number 1 is designed to direct students to solve problems by generating indicators of mathematical thinking. From this question, it is hoped that students with a kinesthetic learning style can answer it by tracing the sticks so they can find the pattern.
2	 In a round-the-clock clap game like the picture above. If the game stops when the person claps 15 times, then how long does the count stop?	Question design number 2 is designed to direct students to solve problems by generating indicators of mathematical thinking. From this question, it is hoped that students with a kinesthetic learning style can produce convincing indicators by demonstrating their body parts.

No	Questions	Explanation
3	What is the sum of each number in the power of $(111{,}111{,}111)^2$?	The design of question number 3 is designed to direct students to solve problems by generating indicators of mathematical thinking. From this question, it is hoped that students with a kinesthetic learning style can find patterns through following activities.

3.2 Focus Group Discussion (FGD)

Researchers with two mathematics lecturers and two mathematics teachers do focus group discussion (FGD). From the results of discussions, there were several suggestions given to improve the editorial so students could easily understand the problem. Based on the results of the FGD, number pattern questions can be used to measure mathematical thinking abilities, because each question leads students to bring up specializing, generalizing, conjecturing and convincing aspects. Table 2 below are some comments and notes for revision.

Table 2. Result Comments And Suggestions

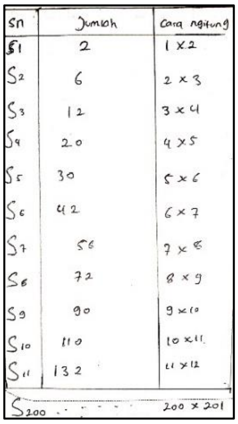
No	FGD members	Comments and Suggestions
1.	A	1. You need to pay attention to the level of difficulty of the questions 2. The position of the image in the question is given below the number 3. There must be high-medium-low level questions
2.	LPI	1. The sentence in question number 3 is made simpler
3.	R	1. Improvements in terms of writing questions that do not match the numbers. 2. It is recommended that additional questions be created that lead to indicators of mathematical thinking ability being measured.
4.	SA	1. The level of difficulty and form of questions are different or not in accordance with what is taught on the LKPD 2. The sentence "Prove the answer is the right answer!" abolished

3.3 Trial results and Interview

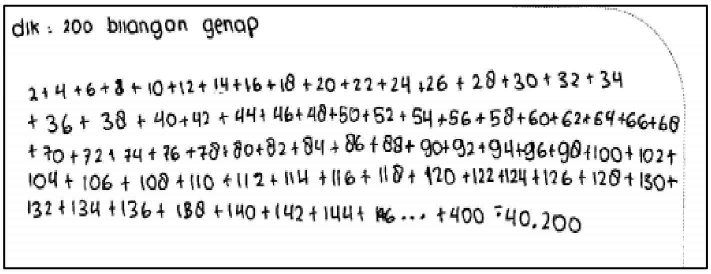
In the steps, subject were given number pattern questions that consist of three questions. The three questions has designed to measure the mathematical thinking abilities of kinesthetic learning style students. Interviews are conducted after students have completed the questions and purpose of the interviews is to collect in-depth information about how students solve problems, the relationship between questions and students' learning styles and to dig deeper into mathematical thinking abilities as seen from four indicators, namely specializing, generalizing, conjecturing, and convincing.

3.3.1 Student Specializing

Based on the test results, it is known that students can write specializing, generalizing, conjecturing, and convincing forms. The specializing indicator in question number 1 is seen when students write the form of adding numbers for each term. Some forms of specialization of students' answers to number 1 are as follows:



Subject 4

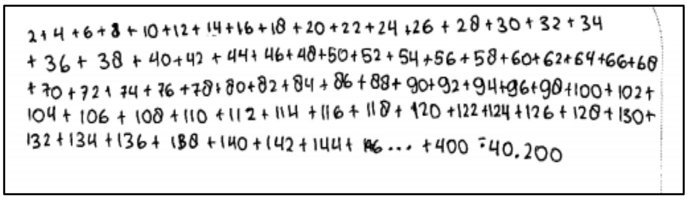


Subject 2

S_n	Amount	How to find
S_1	2	1×2
S_2	6	2×3
S_3	12	3×4
S_4	20	5×5
S_5	30	5×6
S_6	42	6×7
S_7	56	7×8
S_7	72	8×9
S_9	90	9×10
S_{10}	110	10×11
S_{11}	132	11×12
S_{200}	...	200×201

Subject 4 translation

Information : 200 even number

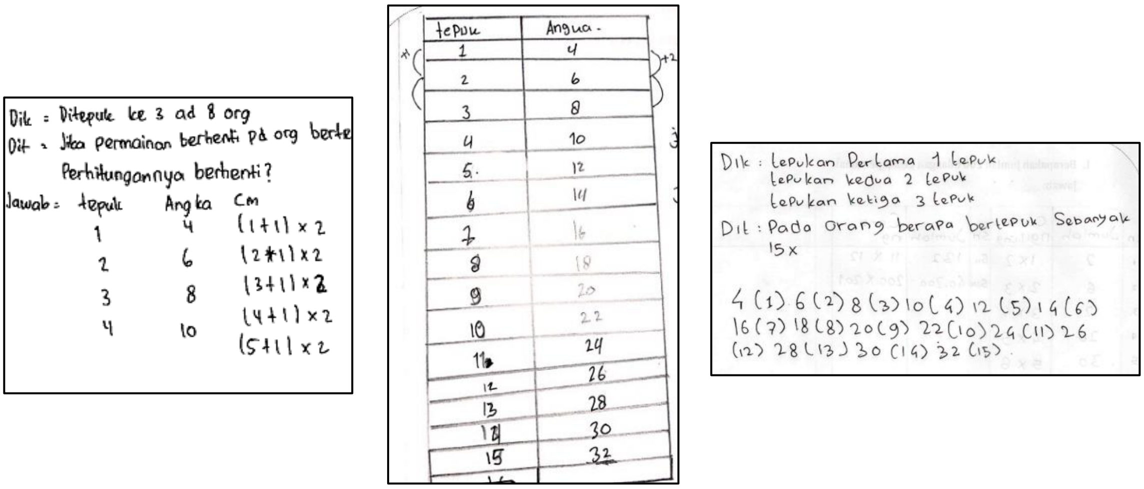


Subject 2 translation

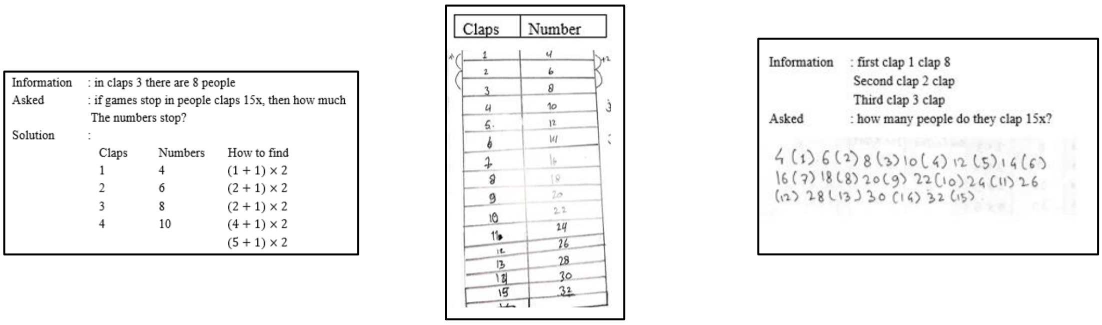
Figure 3. Specialization of students' answers to number 1

On Figure 3, Subject 4 can emerged specialization when she were asked what the meaning of question number 1. Subject 4 answered that to add up the first 200 even numbers with finding the S_{200}. Meanwhile, subject 2 used different way to emerged specialization from subject 4. Subject 2 adding $2 + 4 + 6 + \ldots\ +400$ manually (Lee, 2020). Meanwhile, the other 3 subjects also answered like subject 4.

The specialization in question number 2 can be seen when students write the information in tabular form. Based on Figure 4, Subject 5 can specialization emerged when she was asked what the meaning of question number 2. Subject 5 answered to look for the last number when clapping 15 times or to look for the 15th pattern. Subject 5 also specialization when she explain that when they clap once the number stops at 4, and when they clap twice then the number stops at 6, until they clap 4x and the number stops at 10. Almost the same as Subject 5, Subject 1 can specialization when she specify the number of claps with numbers until they find the final result. Subject 2 gave rise to indicators of specialization by listing numbers with his claps according to the question illustration, but Subject 2 expressed the number of claps in the form "( )". Subject 4 answer like Subject 5, and subject 3 also answer like Subject 2. Figure 4 show specialization in students' answers to number 2.



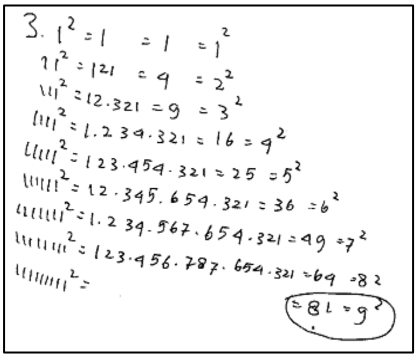
Subject 5 Subject 1 Subject 2

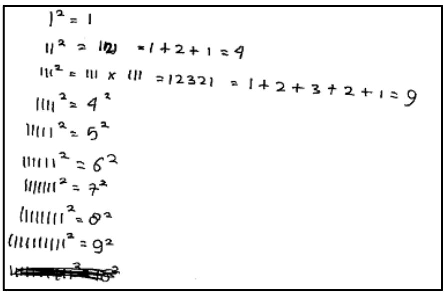


Subject 5 translation Subject 1 translation Subject 2 translation

Figure 4. Specialization in students' answers to number 2

The specializing indicator in question number 3 is visible when students add up each digit of the result$(111.111.111)^2$. Based on Figure 5, Subject 2 can specialization emerged when she wrote down the results of the exponentiation and then added up each digit to find the final result. Meanwhile, Subject 5 only wrote down the results of exponentiation and addition up to 111^2, however Subjects 2 and 5 have brought up aspects of specialization in number 3. Subjects 1 and 3 answer like Subject 5, and Subject 4 also answer like Subject 2.



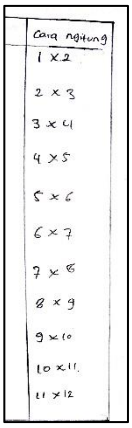


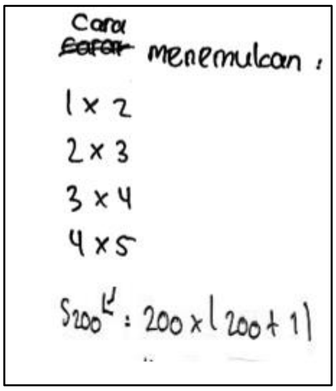
Subject 2 Subject 5

Figure 5. Specialization in students' answers to number 3

3.3.2 Student Generalizing

Then generalizing appears when students are able to get patterns from strategy to calculate each term. Some forms of generalization of students' answers to number 1 are as follows:





Subject 4 Subject 5

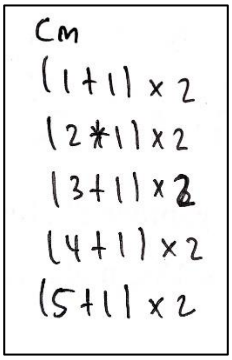
Figure 6. Generalization in students' answers to number 1

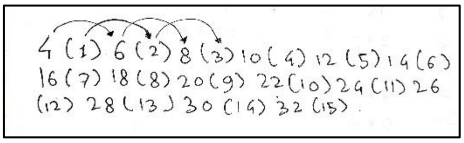
Based on Figure 6, Subject 4 can generalization emerged when she find patterns and relationships between S_n. Where to $S_1 = 2 = 1 \times 2,\ S_2 = 6 = 2 \times 3, S_3 = 12 = 3 \times 4$ and so on until Subject 4 gets a pattern to look for S_{200}. Meanwhile, the way to answer Subject 5 is more detailed than Subject 4, where to $S_1 = 1 \times 2,\ S_2 = 2 \times 3, S_3 = 3 \times 4$ and Subject 5 wrote that for $S_{200} = 200 \times (200 + 1)$. The specialization that emerged in Subjects 1, 2 and 3 was the same as Subject 4. To dig deeper into how subjects can find patterns, researchers conducted interviews with Subject 4

P : " How do you write in the column how to calculate it?"
S4 : " I arranged the sticks according to the number ma'am"
P : "What does that mean?"
S4 : " Well, for example, S_1 the number is 2, ma'am"
P : "Yes, then?"
S4 : " I arranged the sticks in a row, so I counted, 1×2, if S_2there were 6, so I arranged the 6 sticks into 2 rows so that there were 3 per column, so I just counted 2×3"
P : "Why did S_2 you arrange them into 2 rows?"
S4 : " Because that's the 2nd term ma'am"

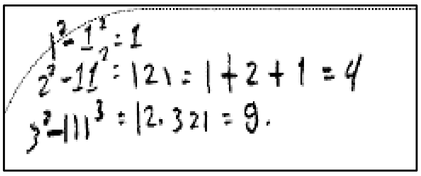
Based on the results of the interview with Subject 4, the researcher knew that Subject 4 showed indicators of specialization in the activity of taking care of sticks. Through the activity of taking care of the sticks, Subject 4 was able to better understand the pattern of the number of even numbers in each term.

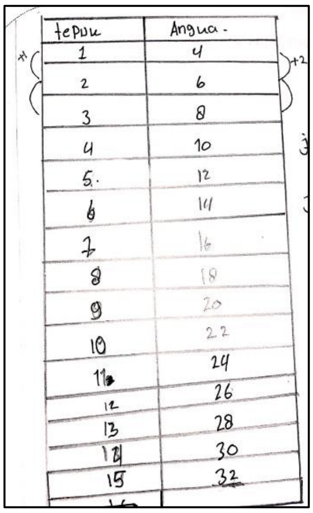
The generalization indicator in question number 2 is also seen when students find a pattern between the claps and the numbers. Based on Figure 7, Subject 5 can generalization appears when she find patterns and relationships between S_n. Where Subject 5 found that for clapping 1, the way to determine it was $(1+1)\times 2$, then for clapping 2, the method was $(2+1)\times 2$, and the 3rd pattern was $(3+1)\times 2$. While the way of answering Subject 2 is different from Subject 5, the generalization aspect appears when Subject 5 finds a pattern between claps, is increasing by 1 and between numbers always increasing by 2. The generalization form of Subject 1 is only written differently from Subject 2, if Subject 2 writes it in line form, while Subject 1 writes it in table form. Subject 3 answer like Subject 2, and Subject 4 also answer like Subject 5.





Subject 2 number 2





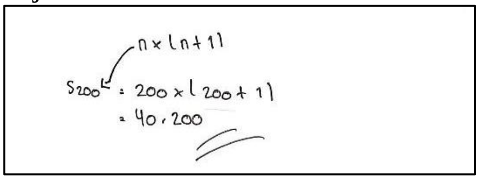
Subject 5 Subject 2 number 3 Subject 1

Figure 7. Generalization of students' answers to number 2 and 3

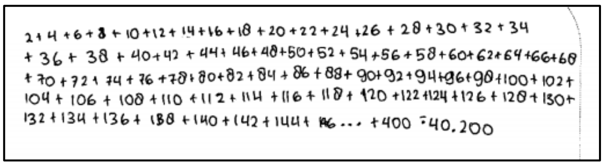
Based on Figure 7, the generalization indicator in question number 3 is also seen when students find a pattern between the number of digits of each exponentiation result and the number of 1s. Subject 2 can generalization appears when she find patterns and relationships between S_n. Where Subject 2 found a pattern of the results sum exponentiation, the pattern is to add the number 1 and then square it. Subject 1 can generalization appears when she found the pattern formed by adding the results of exponents $1^2 - (111.111.111)^2$ is a sequence of numbers with powers. Subject 5 answer like Subject 2, and the method of answering Subjects 3 and 4 was the same as Subject 1, but they did not find the final result.

3.3.3 Student Conjecturing

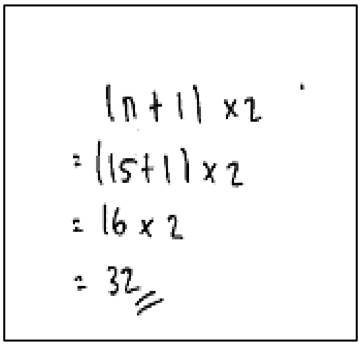
Then conjecturing appears when students are able to find the general formula. Based on Figure 8, Subject 5 can conjecturing appears when she find a general formula for searching S_n. Subject 5 found that to find the sum of the first n even numbers or $S_n = n \times (n+1)$. The conjecturing seen in Subjects 1 and 4 is the same 5, but Subjects 2 and 3 it does not appear because they calculate by adding one by one. Subject 5 can conjecturing appears when she find a general formula for searching S_n. Subject 5 found that to find the last number for n the clap or $(n+1) \times 2$. The conjecturing aspect seen in Subject 4 is the same Subject 5, but in Subjects 1, 2 and 3 it does not appear because they register one by one up to 15 claps. In question number 3 Subject 1 can conjecturing appears when she find a general formula to find the sum of each exponentiation result $(111.111.111)^2$. The general formula obtained by Subject 1 is to add the number 1 and then square it so that the final result of question 3 is $9^2 = 81$. Subjects 5 and 2 did not appear the conjecturing aspect, because they listed the patterns one by one. Meanwhile, Subjects 3 and 4 were unable to bring up the conjectuting aspect because they had not yet found the final result. The conjectural form of student answers for number 1 and 2 is as follows:



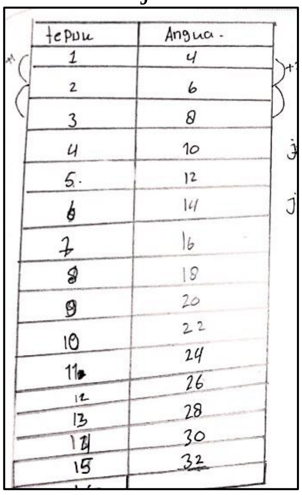
Subject 5



Subject 2



Subject 5



Subject 1

Figure 8. Conjectural form of student answers for number 1 and 2

3.3.4 Student Convincing

The convincing indicator in question number 1 does not appear because students have not been able to find another way to prove the answer. Students only reach the conjecturing stage, where students find the general formula and immediately substitute n what they are looking for. Then the convincing indicator in question number 2 appears when students find other ways to prove their answer. Convincing appeared when Subject 2 was interviewed, the following is the researcher's interview script with Subject 2:

P: "Are you sure about your answer"?
S2: "sure ma'am"
P: "How do you prove that your answer is correct?"
S2: "I demonstrated the rotational clapping game, ma'am,"
P: "Try to show me how you demonstrate it"

"(Subject 2 plays a rotating clapping game, where after saying the number 4 the subject claps 1x, then after saying 5 6 claps 2x, 7 8 claps 3x, 9 10 claps 4x until the clap is 15x)"

After Subject 2 demonstrated it, the researcher obtained the result that Subject 2 was able to prove his answer through movement. Subjects 1, 3, 4 and 5 also brought up convincing aspects when interviewed, they also demonstrated a rotating clapping game. The convincing indicator in question number 3 appears when students find other ways to prove their answer. Subject 2 can convincing appears when she find other ways to prove the answer. When Subject 2 was interviewed about whether there is another way to prove your answer is correct?, then student 2 answered that she could by looking at the pattern of the results of powers from 1^2 to $(11111111)^2$ that the numbers are sequential and repeating so that the result $(111.111.111)^2$ is 12345678987654321 and if add the results equals will be 81. In question number 3, not all subjects were able to answer it completely. Subjects 3 and 4 had not finished working on the questions. After being interviewed, the researcher finally found out why subjects 3 and 4 did not finish.
P : "Why don't you finish answer number 3?"
S3 : "Time's up ma'am, because it took too long to work on question number 1"
P : "If, for example, I gave you 10 extra minutes, would you be able to finish it?"
S3 : "Certainly you can ma'am"
P : "Try to explain, how did you solve it"
S3 : "I look for the results one by one $11111^2, 111111^2, 1111111^2, 11111111^2$*, and* 111111111^2 *then I add up the results ma'am"*
P : "Did you calculate that manually or what?"
S3 : "No manual ma'am, if you look at the results $1^2, 11^2, 111^2, 1111^2$ *(while pointing at the answer on Figure 9) the results are repeated numbers ma'am.*

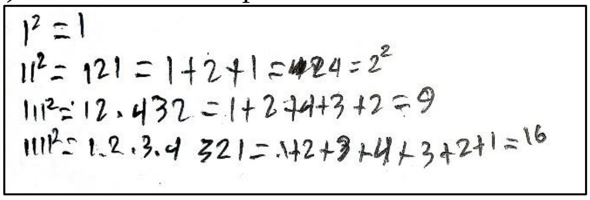


Figure 9. The Answer Subject 3

S3 : "So, if you want to find the results, 111111111^2 *just sort them, ma'am, then add them up"*
Based on the interview with Subject 3, the researcher found out that the reason why the subject did not complete the answer to question number three was because the subject lacked time to find and add up each of the results of the exponents.

3.4 Retrospective analysis

The final stage of this research is retrospective analysis, where at this stage all findings will be analyzed from the results of focus group discussions (FGD), test results and interviews. The results of the retrospective analysis will be used to improve the number pattern questions that have been designed. The findings obtained from the FGD results are improvements in the General Guidelines for Indonesian Spelling. Aspect clarity of grammar in the questions is very important so that students do not misunderstand the problem (Sierpinska, 2000). The level of difficulty of the questions must also vary from easy to medium and difficult, because to measure mathematical thinking skills it does not have to be difficult questions (Pongsakdi et al., 2020). From the results of testing the three questions, it was found that these questions could give rise to indicators of kinesthetic students' mathematical thinking. Where the characteristic that differentiates kinesthetic students from others is that they tend to use their body parts when solving mathematical problems (Alannasir, 2020). This can be seen in problem number 1 where kinesthetic learning style students generalize the pattern obtained by tracing the sticks from the number of even numbers in each term and making a general formula by multiplying the number of long sticks x the number of wide sticks. For question number 1, there was one subject who did not produce conjecturing indicators. After being interviewed, the reason was that the subject understood better if he did it by adding 200 even numbers one by one, even though the subject knew that this method would take a long time, this is in accordance with the findings Adelia et al., (2020) that the subject working manually does not mean the subject does not understand the meaning of the question. In question number 2, there are differences in the way the students answer, but the result is same, there are various ways of answering the students, such as registering the clapping pattern using a table, writing the pattern in rows, and working it out by looking for the general formula (Hwang et al., 2020). So that question number 2 can bring up all the mathematical thinking indicators of specialization, generalization, conjecturing and convincing. Even though not all subjects carry out conjecture, the reason other subjects did not show conjecturing was because this question could be done by registering it up to 15x claps, but when the subjects who did not show the conjecturing indicator were asked how to find the last number if the clap was 100x they had difficulty answering (Sakinah & Avip, 2021). In terms of convincing indicators, question number 2 can already appear even though it is not written. Through interviews, all subjects were able to prove their answers were correct by demonstrating a round-the-clock clapping game. Based on reseach Adelia et al., (2020) that to create convincing it does not have to be through writing, but kinesthetic students create convincing by using body movements.

Based on the results of the interview, the reason students did not find the final result was running out of time (Bernard et al., 2018). Because students are too focused on working on question number 1 so that the time given is not enough to work on question number 3 to completion. However, students can actually answer questions to completion if there is additional time, because during the interview students understand the steps to answer question number 3. There are differences in the steps for solving question number 3, there are students who can immediately see the pattern and there are also students who register them one by one first to be able to find out the pattern (Rosalinda et al., 2023). Susanti et al., (2020) finding that even though each student has various methods they still appeared mathematical thinking abilities. Overall, the subject's answer to question number 3 has given rise to 4 indicators of mathematical thinking: specialization, generalization, conjecturing and convincing. Based on all the results of the retrospective analysis, the researchers found that the questions that had been designed could bring out the mathematical thinking abilities of kinesthetic learning style students, only that question number 3 was not solved well due to limited research time. From the results of trials and interviews, not all subjects gave rise to the 4 indicators of mathematical thinking, due to differences in the way students answered them (Iswari et al., 2019). Of the various student answers, there were students who did not produce conjecturing indicators because the students answered by registering them one by one without making a general formula (Hapizah et al., 2021).

CONCLUSION

The number pattern questions that have been designed can measure students' mathematical thinking abilities. This can be seen theoretically from the results of the Focus Group Discussion (FGD) which stated that the number pattern questions were appropriate based on content, construct and language. It can be seen from the test results that the research subjects were able to answer the test questions well, where the three questions that had been designed could give rise to indicators of mathematical thinking. Specializing indicators can be seen when students write the form of adding numbers for each term. Indicator Generalizing is seen when students find patterns by listing them one by one or using tables, conjecturing indicators when finding the general formula, and convincing indicators when finding other ways to prove the answer. Based on the interview results, students' answers were obtained through the activity of managing and simulating questions using body parts.

This research only focuses on finding out the extent of students' mathematical thinking abilitiy with a kinesthetic learning style. For researchers who will conduct research on similar topics, it is should provide more time so that students are not in a rush to complete the questions. Furthermore, other researchers can continue this research by testing questions on students with other learning styles such as audio or visual learning styles.

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