Errors of completing mathematical problems on number pattern material

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Abstract. Error analysis is needed to provide information about student weaknesses to correct mistakes. This study analyzes grade VIIIA students' errors of MTs Negeri 3 Banjarnegara on number pattern material. The data obtained using a multiple-choice test accompanied by the student's working steps. The data were analyzed using percentages and described qualitatively. The results showed that the errors of male students tended to be higher than that of female students. Male and female students in the number pattern material made conceptual, procedural, and error due to lack of thoroughness.

1. Introduction
Learning and assessment are two interrelated things. Knowledge and skills obtained from education. At the same time, identifying levels of knowledge and skills acquired from evaluations [1]. The results of the assessment indirectly reflect the learning undertaken. Assessment results do not always match expectations. These results are due to mistakes made by students. Teachers in education can use errors that arise spontaneously or on purpose [2].

Mathematical errors because generally caused by students' inability to understand concepts so that they are wrong to use formulas and operations correctly [3]. Meanwhile, the difficulty in solving problems is due to difficulties in understanding keywords or essential information [4]. As a result, errors will occur when planning strategies, selecting formulas, and procedures [5].

Error analysis is essential to do to determine the cause of the error [6], get an explanation, and think about possible improvements to the strategy [7]. Error analysis helps teachers in the learning process and can plan further learning [8]. By identifying errors, students' level of a mistake is determined [9].

To perform error analysis requires identifying, interpreting errors, and the ability to correct mistakes made [10]. The ability to identify and interpret mistakes is needed to collect error data and categorize the types of committed errors. Meanwhile, the ability to correct mistakes is required to design improvement strategies based on the results of students' interpretation of errors. There are several types of errors, including conceptual errors, operational errors, basic errors [6, 11-12], a mistake by carelessness [11], computing, planning, creating mathematical models, implementing problem-solving strategies [12].

Number patterns are one of the materials taught in junior high schools. This material is essential to teach because, in number pattern material, students must generalize a number pattern. The ability of students to make generalizations is needed because it can help students solve problems. [13]. Based on the math teacher's information, some of the mistakes students often experience when working on number
pattern problems are errors in using formulas, calculation errors, errors in determining patterns due to just guessing, and mistakes in changing mathematical models.

The differences in character between men and women can affect the mistakes made. Women tend to have more anxiety than men but tend to be more persistent [14]. Men are more likely to think logically and mathematically than women, whereas women can control emotional reactions and express their feelings than men [15].

Based on these problems, students' mistakes in solving problems in the number of pattern material in gender discussed. What is the percentage error of male and female students per indicator of achievement in the number pattern material?

2. Method

This research is a quantitative and qualitative descriptive study. The research was conducted at MTs Negeri 3 Banjarnegara with the subject of class VIIIA students. Data obtained by tests on number pattern material. Questions in the form of multiple-choice, totaling 20 items with six indicators of competency achievement. In addition to choosing the right answer, students write down the notebook process. The data obtained were then analyzed for errors and presented as a percentage. Several errors were analyzed qualitatively.

3. Results and Discussion

The data was collected using a multiple-choice test of 20 items with four answer choices. Students asked to write down the steps in the process in a notebook. The questions are developed based on the number pattern material indicator. The items made into three categories, namely: easy, medium, and complicated categories.

There are six indicators used. The distribution of items developed are in Table 1 below.

### Table 1. Distribution of number pattern material problems

| No | Indicator | Easy | Medium | Difficult | Total | Percentage (%) |
|----|-----------|------|--------|-----------|-------|-----------------|
| 1  | Determine the number sequence pattern | 6,7 | 9,11,12 | 8,10 | 23 | 35 |
| 2  | Determine the object configuration array pattern | 13 | 14,15,19,20 | 5 | 18 | 25 |
| 3  | Solve the problem related to the number sequence pattern | 18 | 1 | 9 | 28 | 30 |
| 4  | Solve the problem related to the object configuration array pattern | 1,2 | 2 | 10 | 14 | 20 |
| 5  | Analyze the problem related to the number sequence pattern | | 16,17 | 2 | 18 | 25 |
| 6  | Analyze the problem to related to the object configuration array pattern | 4 | 3 | 2 | 9 | 10 |
|    | Total | 3 | 11 | 6 | 20 | 100 |

Table 1 above shows that the questions into three categories: easy, medium, and challenging. The questions consisted of 3 items in the easy category; 11 items in the medium category; and six items in the difficult category. The most extensive percentage measures indicators about making generalizations from patterns in a sequence of numbers. The aim to determine the necessary abilities of students in making generalizations from the number pattern material. This ability is the basis for solving problems...
and analyzing problems related to number sequence patterns and sequence patterns of object configurations.

The research sample was students of class VIII A MTs Negeri 3 Banjarnegara. Class VIII A students consist of 12 male students and 17 female students. Data obtained using tests. All students follow the test. The minimum completeness criteria (KKM) for the number pattern material is 65. The test results presented in Table 2 below:

| Gender | Students | Average | Difficult | Completed (%) | Not completed | Not completed (%) |
|--------|----------|---------|-----------|---------------|--------------|------------------|
| Male   | 12       | 65      | 7         | 58.33         | 5            | 41.67            |
| Female | 17       | 78      | 14        | 82.35         | 3            | 17.65            |
| total  | 29       | 72      | 21        | 72.41         | 8            | 27.59            |

Table 2. The test results of class VIII A students

That the percentage of female students' completeness is better than that of male students, the entirety of female students reached 82.35%, while male students were 58.33%. The average score of female students is better than the average score of male students. The average score for female students was 78.00, while the mean score for male students was 65.00 of the 12 male students, seven students have exceeded the specified KKM limit or equal to 58.33%. Completeness of female students was 82.35%. These results indicate that the number of female students' completeness is more than the number of completeness of male students. If it is seen from the total number of class VIII A students, the average value is 72.00. Completeness reaches 72.41%. This result is quite encouraging because the percentage of students who have completed is more than 70%.

The following will be present the percentage of student errors in working on number pattern questions for each indicator of competency achievement.

3.1. Determine the number sequence pattern

The first indicator consists of 7 questions: two easy categories, three medium categories, and two difficult categories. Table 3 below presents the percentage of student errors in working on the items on these indicators.

| Question number | Category | Male   | Female | Total  |
|-----------------|----------|--------|--------|--------|
| 6               | easy     | 8.33%  | 0%     | 3.45%  |
| 7               | easy     | 50%    | 5.88%  | 24.14% |
| 8               | difficult| 41.67% | 23.53% | 31.03% |
| 9               | medium   | 50%    | 35.29% | 41.38% |
| 10              | difficult| 50%    | 47.06% | 48.28% |
| 11              | medium   | 33.33% | 58.82% | 48.28% |
| 12              | medium   | 25%    | 0%     | 10.34% |
| Average         |          | 36.90% | 24.37% | 34.7%  |

Table 3 above shows that the percentage of male students' errors is higher than female students. Male students experienced difficulties, especially in question number 7 to number 10. Female students tended to experience problems with questions number 9 to number 11.
3.2. *Determine the object configuration array pattern*

**Table 4.** The percentage error indicator determines the object configuration array pattern

| Question number | Category | Male  | Female | Total  |
|-----------------|----------|-------|--------|--------|
| 5               | difficult| 75%   | 70,59% | 72,41% |
| 13              | easy     | 33,33%| 5,88%  | 17,24% |
| 14              | medium   | 16,67%| 29,41% | 24,14% |
| 15              | medium   | 33,33%| 17,65% | 24,14% |
| 19              | medium   | 41,67%| 10,53% | 24,14% |
| 20              | medium   | 33,33%| 0%     | 13,79% |
| **Average**     |          | 38,89%| 22,34% | 29,31% |

The highest error in question number 5, shown in Table 4 above. In question number 5, students asked to determine the 8th pattern of many equilateral triangles of one unit size. The error occurred because they only counted the unit triangles that were blue or white. The error is allegedly due to misunderstanding the question in question.

3.3. *Solve the problem related to the number sequence pattern*

Students asked to determine the 9th and 10th numbers from a known sequence of numbers. The 1st number corresponds to the 3rd, 5th, and so on. Simultaneously, the 2nd number is related to the 4th, 6th, and so on. There were two male students and one female student who answered incorrectly. This result is very encouraging because the majority of students can solve questions on this indicator.

3.4. *Solve the problem related to the object configuration array pattern*

**Table 5.** The percentage error indicator solves the problem related to the object configuration array pattern

| Question number | Category | Male  | Female | Total  |
|-----------------|----------|-------|--------|--------|
| 1               | medium   | 25%   | 0%     | 10,34% |
| 2               | medium   | 25%   | 0%     | 10,34% |
| **Average**     |          | 25%   | 0%     | 10,34% |

Table 5 above shows that female students have no difficulty solving the problem related to the object configuration array pattern. All-female students answered correctly on the two questions given. Twenty-five percent of students or three male students had difficulty working on these two questions. Students asked to determine the number of bricks in the lowest pile and determine the number of seats in the hall.

3.5. *Analyze the problem related to the number sequence pattern*

**Table 6.** The percentage error indicator analyzes problems related to a pattern in a sequence of numbers.

| Equation number | Category | Male  | Female | Total  |
|-----------------|----------|-------|--------|--------|
| 16              | difficult| 50%   | 47,06% | 48,28% |
| 17              | difficult| 16,67%| 47,06% | 34,48% |
| **Average**     |          | 33,34%| 47,06% | 41,38% |
Based on Table 6 above, the percentage of female students’ errors for both numbers is relatively high. Meanwhile, male students experienced difficulties in number 16. The rate of mistakes reached 50%. In other words, half of the male students experienced problems in question number 16. In question numbers 16 and 17, students asked to analyze patterns formed based on a known sequence of numbers.

3.6. Analyze the problem to related to the object configuration array pattern.

Table 7. The percentage error indicator analyzes the problem to related to the object configuration array pattern

| Equation number | Category   | Male    | Female  | Total  |
|-----------------|------------|---------|---------|--------|
| 3               | difficult  | 33.33%  | 23.53%  | 27.59% |
| 4               | medium     | 50%     | 11.76%  | 27.59% |
|                 | Average    | 41.67%  | 17.65%  | 27.59% |

Half of the male students did wrong in doing question number 4, as presented in Table 7 above. Male students had a higher percentage of errors than female students. In other words, the ability to analyze problems on the six indicators for female students is better than that of male students.

3.7. The comparison of the percentage of errors for each indicator.

The comparison of the percentage of errors for each indicator of the questions is present in Figure 1.

![Figure 1. The percentage of error for each indicator](image.png)

Figure 1 above shows that the percentage of male students’ errors tends to be higher than that of female students. In indicator 5, the rate of female students is higher than male students. All-female students can work on the 4th indicator question. Female students’ highest error is on the 5th indicator, while the male students are in the 6th indicator.

The following are some of the mistakes made by male and female students.
3.8. Male student error

Figure 2. Misunderstanding the problem

In question, students asked to analyze and choose one of the statements that are considered correct—a problem related to the 6th indicator. Figure 2 shows that students have made initial mistakes in understanding the information in the questions. In the case, there is information that the length of the shortest rope is 9 cm, the size of the second rope is twice the length of the first rope; the length of the third rope is twice the length of the second rope. Students write $b = 2$, which means the difference is two. Besides, these students also make conceptual errors, where students think that the problem can be solved using the arithmetic sequence formula, which should be solved using geometric sequences.

Figure 3. Errors complete the number pattern

In question, number 10 about indicators make generalizations from patterns in rows of numbers. Students asked to complete two letters. The male student ends the letter N in the 4th syllable and the letter T in the 7th syllable. The student made a procedural error because what should have shifted two letters, and the student only shifted one letter. As a result, the answer given is wrong, as in Figure 3 above.

3.9. Female student error

Figure 4. Basic error

Female students are not careful in solving problems, so there is a basic error. The fault lies in using the number sign shown in Figure 4 below. Apart from being less thorough, it suspected that students had difficulty dividing fractions.
Likewise, in question number 14, female students made basic mistakes due to inaccuracy. In the 5th term = 30, for the 6th term, it is obtained from the 5th term + 12. Students write the result 22, which should be 42. As a result, the following terms are wrong, as in Figure 5 above.

Based on the error analysis results above, in general, the percentage of male students' errors tends to be higher than that of female students. They are because women are more diligent in solving problems [14]. Only one indicator, namely the 5th indicator about analyzing the number pattern problem, the percentage error of female students is higher than that of boys. They are because male students think more logically and mathematically than females [15].

4. Conclusion
Based on the results above it shows that the percentage of male students' errors is greater than that of female students. The highest rate of female students' errors is on indicators analyzing problems related to patterns in numbers. Male and female students, namely, made three types of mistakes, that are, conceptual errors where students incorrectly used the formula, procedural errors where students were wrong in the work, errors because they were not careful enough to give a number sign. Henceforth, error analysis can be carried out based on aspects of the cognitive level.

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