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# SAIZU INTERNATIONAL CONFERENCE ON TRANSDISCIPLINARY RELIGIOUS STUDIES (SAIZU ICON-TREES)

ISSN 2964-5859, 2023, Pages 211-228

DOI: <https://doi.org/10.24090/icontrees.2023.341>

## Proceeding of 3<sup>rd</sup> Internasional Conference on Implementing Religious Values on Transdisciplinary Studies for Human Civilization

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### Analysis of Error in Solving Fraction and Decimals Viewed from the Nolting Theory in Madrasah Ibtidaiyah Students

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**Abstract:** This research was driven by the low score of mathematics in fractions and decimals at MI Negeri 1 Banyumas. The ability of students during the pandemic transition is different from students who attended school before the pandemic. This is known from the average daily test scores on fractions and decimals problems. Therefore, this study aims to analyze: (1) the types of errors and (2) the proportion of errors made by students in solving fractions and decimals problems in terms of the Nolting Theory. This research is a field research involving 28 grade IV students at MI Negeri 1 Banyumas as a subject. The data obtained from the results of tests and interviews with students. Data analysis was carried out using a quantitative descriptive approach to describe the types of errors and the proportion of each error. The results showed that of the 28 grade IV MI Negeri 1 Banyumas students, several types of errors were found, namely misdirection errors, careless errors, conceptual errors, application errors, test taking errors, and study errors. Quantitatively the largest proportion of errors in each number are careless errors.

**Keywords:** *decimals; errors; fraction; nolting*

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#### A. INTRODUCTION

Mathematics is a subject that is studied at every level of education, from elementary school to higher education. According to Marpaung (2018, p. 3), in the modern era with advances in science and technology, mathematics has an important role in developing modern science. In addition, mathematics is a field of science that is closely related to everyday life. Almost all aspects of life are related to mathematics,

such as counting, measuring and buying and selling transactions. So, education not only prepares students to understand mathematics, but rather students are able to apply mathematics in everyday life or known as numeracy skills numerasi (Ekowati & Suwandayani, 2018, p. 22). Teachers and students must master strong literacy and numeracy skills in order to compete with other nations in the digital age as it is today.



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The elementary education (Madrasah Ibtidaiyah) level has implemented a numeracy evaluation carried out through AMBK (Asesmen Madrasah Berbasis Komputer) for fifth grade students. However, in fact, Indonesian nation's literacy and numeracy levels are very low, which is a challenge that must be faced in the world of education, especially teachers and students (D, D., Khasanah, M., & Putri, A. M. (2021). This also happened at MI Negeri 1 Banyumas as found during the preliminary research.

According to the fourth grade teacher at MI Negeri 1 Banyumas, some students said that mathematics was a difficult subject. Only a small proportion of students like mathematics because they have not found the concept of learning mathematics easy. The most problems with low math skills are fractional material which includes fractional and decimal operations packaged in word problems. This is in line with the opinion (Suciati & Wahyuni, 2018, p. 424), the problem that is commonly experienced by students is difficulty in solving math problems of the type of stories and fractions. This can affect the ability to solve contextual problems at the next level. Kou Murayama (in S.B, 2014, p. 103) who is a psychologist at the University of California Los Angels, United States, said that mathematical intelligence does not depend on intelligence level (IQ). According to him, the influencing factors are high learning motivation, a good mindset related to mathematics, and learning techniques adapted to students.

The concept of decimal fractions is important to learn and understand in

relation to other mathematical material and in everyday life. However, the conditions that occurred at MI Negeri 1 Banyumas during observations obtained information from 28 students that 60% obtained scores below the Minimum Completeness Criteria. The data is obtained from the results of daily test scores, namely the lowest value of fraction material compared to other material. This shows that there are still many students who make mistakes, even though it has become a pilot school for the Free Learning Curriculum. The mistakes made by students will be analyzed using the Nolting Theory, in (Nolting, 2012, p. 116), namely as follows:

1. Misread directions errors
2. Careless errors
3. Concept errors
4. Application errors
5. Test-taking errors
6. Study errors

Based on this background, this study aims to determine (1) the types of errors and (2) the proportion of each error made by students in terms of the Nolting Theory in the hope that it can contribute to assisting teachers in mapping the types of errors and planning solutions.

## **B. MATERIALS AND METHODS**

This study uses a quantitative descriptive method. According (Rahma, 2014, p. 46), research with a quantitative descriptive method is research in which the data is in the form of numbers, starting from data collection, data processing, to data presentation. The quantitative descriptive

method was chosen for the reason that it wanted to describe an event resulting from this study in detail and to analyze quantitative data in the form of numbers or statistics in the study by taking data based on field facts (Butarbutar et al., 2022, p. 41).

The subjects in the study were 28 students of class IV Zaid at MI Negeri 1 Banyumas. Data collection techniques used in this study are tests and non-tests (interviews). The test obtained data on the types of student errors when working on questions (Sukmawati & Amelia, 2020, p. 43). The number of questions given was 4 questions which covered fraction material in class IV (fraction operations, sorting fractions, changing decimals to fractions, and word problems). Then interviews were conducted with 9 students to represent students with high, medium and low ability categories. This is done to obtain supporting information on the answers to the answers sheet.

The questions in the Instrument test have been adjusted to the math material for fractions and decimals in grade IV and the 2022 Independent Learning Curriculum (KMB) teaching module used by teachers. Problem number 1 contains instructions for paying attention to the problem, then followed by an order to sort the fractions. The sort order aims to measure students' understanding of the difference in the large and small values of a fraction. Problem number 2 consists of commands to sort and convert fractions into decimals or decimals into fractions. Furthermore, problem number 3 contains commands to convert fractions to decimals. At the last, question

number 4 contains arithmetic operations questions which are presented in the form of word problems.

**Table 1. Indikator of Errors**

No.	Type of Error	Indicator
1.	<i>Miss-direction errors</i>	Do not read the instructions correctly
		Do not understand the instructions in the problem
2.	<i>Careless errors</i>	Do not write down known and asked information
		Wrong writing arithmetic operation sign
		Wrong calculation
3.	<i>Concept errors</i>	Do not understand the concept of fractional operations
4.	<i>Application errors</i>	Do not change word problems into mathematical symbols
5.	<i>Test-taking errors</i>	Do not order the procedure for working on the questions correctly
		Do not work on the problem until the conclusion
6.	<i>Study errors</i>	Do not pay attention to the teacher when learning mathematics
		Haven't found a suitable math learning style yet

Data on types of student answer errors on the answer sheet were analyzed quantitatively. To find out the percentage of the number of errors made by students in solving math problems on fractions and decimals, the following formula is used.

$$\text{Proportion of Errors} = \frac{\Sigma \text{ students making error}}{\Sigma \text{ all student}} \times 100\%$$

As for the descriptive analysis, analysis was carried out through the process of data reduction, data presentation then verification, and data conclusion.

### C. RESULT AND DISCUSSION

The results of the analysis of the data obtained from the answers to the test sheets were analyzed based on the Nolting Theory (Nolting, 2012, p. 116). Answer sheet analysis was carried out by identifying each type of error made by each student. Details of the types of errors in working on fractional material problems can be seen as follows.

**Table 2. Type of Errors**

Question	MDE	CE	COE	AE	TTE
1	-	10	3	-	1
2	3	7	5	-	4
3	-	8	4	-	3
4	2	9	-	6	4

The table above shows the number of student errors in each number. Furthermore, the proportion of each type of error in each number can be seen in table 3.

**Table 3. Proportion of Each Type of Error**

Ques- tion	MD E	CE	COE	AE	TTE	True Answ er
1	-	36%	11%	-	3%	50%
2	11%	25%	18%	-	14%	32%
3	-	29%	14%	-	11%	46%
4	7%	32%	-	22%	14%	25%

Information:

MDE : Misread Direction Errors

CE : Careless Errors

COE : Concept Errors

AE : Application Errors

TTE : Test Taking Errors

In the table above, it can be seen that Careless Error and Test Taking Error appear in each number. Meanwhile, the Application error only appears in number 4. This is because number 4 is a complex problem about fractions in the form of word problems. Of all the errors made by students, the most frequent errors are careless errors. Indicators of careless errors include not writing back the information in the problem to make the work process easier, mistakes in doing calculations (especially for large numbers), writing wrong numbers, and writing wrong signs for arithmetic operations. This can happen when students feel rushed in doing the work, are not careful and the body's stamina factor.

To strengthen the data, interviews were conducted with 9 students representing

high, medium and low abilities. The following are the results of interviews regarding the types of errors made by students according to the number of questions.

### 1) Question 1

From the results of the analysis of the answer sheets and interviews with one of the samples, it can be seen that the sample made 2 errors in one question. The type of error made was in the form of an operation sign error and did not complete the problem completely. Students said they understood the instructions in the problem, but in the middle of the work process they were confused about the next step. So that it is obtained that students make a second error, namely test taking errors because they do not write down the answers completely.

The same error was expressed in the research conducted (Aroysi, n.d., 2018, p. 153). In this study it was found that 65.65% of students did not complete the problem solving procedure because they were confused about the next process, thus emptying the answers.

The image shows a handwritten solution for a fraction addition problem. The problem is  $\frac{12}{4} + \frac{4}{6}$ . The student has written  $\frac{12}{4} + \frac{4}{6} = \frac{12+4}{24} = \frac{16}{24}$ . There are several errors: 1. The denominator 24 is incorrect; it should be 12. 2. The numerator 16 is incorrect; it should be 16. 3. The final answer is not simplified. 4. There are some crossed-out numbers and symbols, indicating confusion or correction.

Figure 1. Error in Question 1

Based on the results of the analysis of the answer sheets and interviews, the reasons for the students' carelessness were:

- Haste when working on problems

- Forget about the process of working on the problem

### 2) Question 2

The biggest percentage of errors in number 2 is careless errors, which is 25%. Based on the analysis of answer sheets and interviews, data can be obtained that students make 2 errors, namely careless errors and test-taking errors. Students have been able to write down answers, but only to change fractions and not sort the values.. Fatmadiyah (Lestari, 2021, p. 59) states that students are in a hurry to finish quickly so that it can lead to carelessness in writing down numbers and writing down the next steps.

The image shows a handwritten solution for a fraction multiplication problem. The problem is  $\frac{10}{2} \cdot \frac{20}{8}$ . The student has written  $\frac{10}{2} \cdot \frac{20}{8} = \frac{20}{4} = \frac{2}{8} = \frac{2}{2} = \frac{1}{4}$ . There are several errors: 1. The first fraction is  $\frac{10}{2}$ , which is simplified to 5. 2. The second fraction is  $\frac{20}{8}$ , which is simplified to  $\frac{5}{2}$ . 3. The student has written  $\frac{20}{4}$  instead of  $\frac{10 \cdot 20}{2 \cdot 8} = \frac{200}{16}$ . 4. The final answer is  $\frac{1}{4}$ , which is incorrect.

Figure 2. Error in Question 2

So it can be understood that students make these types of errors because:

- Students write the wrong numbers, so they cannot take the next step
- Students do not check back incomplete answers, so they make errors.

Sehingga dapat dipahami bahwa peserta didik melakukan jenis kesalahan :

**3) Question 3**

3. A.  $\frac{4}{10} = 0,4$       C.  $\frac{8}{100} = 0,08$   
 B.  $\frac{4}{20} = 0,8$       D.  $\frac{75}{100} = 0,75$  ✗

Figure 3. Error in Question 3

Based on the analysis of answer sheets and interviews, the information obtained was that students made careless error. Students know how to do the questions, but are careless so they make a wrong calculation. In addition, students made application errors in this case changing fractions into decimals.

Research conducted by (Rahmawati & Permata, 2018, p. 173) revealed that students who did not understand the questions and the process disturbed their concentration. 81.67% of students made mistakes in understanding and were careless in performing arithmetic operations.

The following are the reasons students make error:

- Students are confident when working on questions, but do not check back the answers that have been written.
- Students do not understand the concept of changing fractions to decimals so that students are careless in writing and performing arithmetic operations.

**4) Question 4**

④  $\frac{24}{3} + \frac{1}{8} = \frac{24+4}{32} = \frac{28}{32} + \frac{1}{2} = 56$

Figure 4. Error in Question 4

The most dominant type of error in question number 4 is careless errors, which is 38%. From the analysis of the answer sheets and interviews, the sample made a careless mistake, misunderstood the concept, and did not complete the problem completely. In addition, students said they did not understand the meaning of the questions in the story of the process to change the fractions.

It can be understood that students make several types of mistakes, namely:

- Misunderstanding the instructions for the question, this can happen when the participant only reads the question once and doesn't understand it.
- Students make careless mistakes with indications of incorrectly writing the results of arithmetic operations.
- The mistake of not completing the problem until it is finished.
- And the mistake of not understanding the concept of story questions.

After describing the mistakes made by students per item. Next is the discussion of student errors based on ability.

**1) High capability**

Students with high abilities are dominant in making careless and

conceptual errors. Errors made such as incorrectly sorting fractions, even though the process is correct. The next mistake is a concept error in the form of incorrectly changing fractions to decimals even though there are 1-2 points in a question that has 4 points.

During the interviews, students said they liked mathematics and studied at home with their parents, tutors or independently. So that when you are at school you are used to it and can do the questions well.

### **2) Moderate ability**

Students with moderate abilities make more careless errors, namely the wrong part of doing arithmetic operations. Students feel that they are correct so they do not check their answers again.

During the interviews, some students said they liked mathematics and some did not like it. This was proven when at home some studied to review the material and some did not study again.

### **3) Low ability**

Students with low abilities make many conceptual errors and carelessness. This is evidenced by errors in counting, errors in writing operation signs, and not understanding fraction operations and converting fractions to decimals and vice versa.

When interviewed, students said they did not like mathematics and preferred social or arts subjects. Students say they only learn mathematics if there is homework, because they already think mathematics is too difficult to understand.

## **D. CONCLUSION**

Based on the results of the research and discussion, it can be concluded that there are 6 types of student errors when solving math problems on fractions based on the Nolting Theory. The first is misread directions errors, the second is careless errors, the third is concept errors, the fourth is application errors, the fifth is test taking errors, and the last is study errors. Overall, students make these six types of errors in every question. Then the proportion of each error made by students for each number, the dominant error in each question is careless errors. Another type of error is Study errors of 4 students out of 9 students with a percentage of 44%. As many as 9 students were interviewed, 4 said that they did not like mathematics and their parents always assisted them in learning. For this reason, teachers need to provide appropriate treatment for students to avoid making errors when working on fractions and decimals.

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