Analysis of Student Errors in Solving Story Problems on Social Arithmetic Material

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Abstrak.

Aritmetika sosial merupakan salah satu materi pada mata pelajaran matematika di kelas VII semester genap yang harus dikuasai dengan baik oleh siswa. Materi ini menyangkut kehidupan sosial, terutama penggunaan mata uang. Penelitian ini bertujuan untuk menganalisis kesalahan-kesalahan yang di lakukan oleh siswa menurut teori Newman dalam menyelesaikan soal cerita aritmetika sosial. Metode yang digunakan untuk pengambilan data terdiri dari tes tertulis dan wawancara. Tes tertulis diberikan kepada 27 orang siswa dari kelas IXC, terdiri dari 5 butir soal uraian, setelah itu dari hasil tes tertulis diambil 5 siswa yang diperkirakan membuat kesalahan-kesalahan menurut Newman untuk menjadi subjek wawancara, setelah proses wawancara didapatkan bahwa 5 siswa tersebut membuat 5 kesalahan menurut teori newman yaitu kesalahan membaca, kesalahan memahami, kesalahan transformasi, Kesalahan Ketrampilan Proses. Kesalahan Penulisan Jawaban Akhir. Dan dianalisis juga jawaban dari 27 orang siswa dari kelas IXC di SMP N 2 Langowan dengan menggunakan teori newman dan mendapatkan hasil yaitu sering terjadi adalah kesalahan penentuan jawaban akhir dengan persentase sebesar 55,93%, kesalahan keterampilan proses 53,38%, kesalahan transformasi sebesar 49,15%, kesalahan memahami 33,05%, kemudian kesalahan membaca 32,20%.

Kata kunci: Analisis Kesalahan, Teori Newman.

Abstract.

Social arithmetic is one of the materials in mathematics subject in class VII even semester, which students must master well. This material concerns social life, especially the use of currency. This study aims to analyze the mistakes made by students according to Newman's theory in solving social arithmetic word problems. The method used for data collection consisted of written tests and interviews. The written test was given to 27 students from class IXC, consisting of 5 essay questions. After that, from the results of the written test, 5 students who were thought to have made mistakes, according to Newman, were taken to be interview subjects. After the interview, it was found that the 5 students made 5 errors according to Newman's theory reading errors, understanding errors, transformation errors, and Process Skill Errors. Error Writing Final Answer.

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Moreover, analyzed the answers of 27 students from class IXC at SMP N 2 Langowan using Newman's theory and got the result that often occurs is an error in determining the final answer with a percentage of 55.93%, process skills error of 53.38%, transformation error of 49.15%, 33.05% understanding errors, then 32.20% reading errors.

Keywords: Error Analysis, Newman's Theory.

INTRODUCTION

Mathematics is a very important subject in everyday life and one of the subjects taught at every level of education. Mathematics lessons must be given to all students to equip them to think logically, analytically, systematically, critically, and creatively and work together (Yusri, 2018; Domu, 2023). This means that mathematics plays a very important role in various dimensions of human life, in everyday life, in the development of science and technology, and in forming students' positive attitudes (Domu & Mangelep, 2020; Rompas, 2023). Problems in everyday life related to mathematics are usually outlined in word problems (Kambey & Mangelep, 2019; Domu & Pesik, 2020; Nangon et al., 2022). Math word problems provide a real picture of real-life problems (Mangelep et al., 2013; Domu et al., 2022; Runtu et al., 2023). Word problems train students to think analytically (Domu & Mangelep, 2019; Tiwow et al., 2022).

Developing students' ability to solve math word problems is one of the important goals of learning mathematics at school because word problems can improve problem-solving skills. Math word problems require logical reasoning and understanding between concepts (Mangelep, 2017; Kalengkongan et al., 2021; Boham & Domu, 2021). According to Prasetyo (Dinnullah, 2019), student activities in solving math word problems are not just in the form of the answers to the questions obtained, but students must know the procedure for solving story problems systematically and the stages in the completion process.

Social arithmetic is one of the materials in mathematics subject in class VII even semester, which students must master well. This material concerns social life, especially the use of currency. In learning mathematics, one of the important aspects that students must master is solving math problems and finding solutions (Mangelep, 2017; Kelung et al., 2018; Londa & Domu, 2020; Tiwow, 2022). Solving math problems is usually done by solving word problems (Bernadet et al., 2018; Mangelep, 2020). Solving word

problems is one of the most difficult aspects of mathematics, so students still need to correct their mistakes (Sari et al., 2018; Sulistyaningsih & Mangelep, 2019). According to Zakaria (Dinnullah, 2019), mistakes in solving math problems often occur in writing or orally. Errors in solving word problems were students' mistakes in solving the story problems presented (Mangelep, 2015; Makahenggeng et al., 2018). Errors in solving word problems are generally related to the inability to imagine the problem in reality, or it could also be in terms of understanding (Manambing et al., 2018).

Based on interviews conducted with teachers in mathematics class VII at SMP Negeri 2 Langowan on social arithmetic material, information was obtained that there were still many students who needed to improve in solving word problems on social arithmetic material. Students need to understand the concept of social arithmetic, and many students need help solving questions, especially in the form of descriptions. Hence, students need help converting word problems into mathematical models and more understanding of thinking.

With the above errors, students' mathematics learning outcomes decrease. Therefore, it is necessary to do an error analysis. To analyze these errors, the Newman procedure was used, including the following: 1) reading error, 2) comprehension error, 3) transformation error, 4) processing skill error, and 5) encoding error (error concluding). Newman's procedure was chosen because this procedure is a method developed by Newman and is used to identify categories of errors in the answers of an essay test. For example, when misunderstanding a problem, students often need to understand the gross, net, or our understanding.

METHOD

This type of research is descriptive research with a qualitative approach based on post-positivism philosophy, namely the philosophy of correcting mistakes, used to research natural object conditions, where the researcher is the key instrument. The data collection technique was triangulation (combined), data analysis was inductive/qualitative, and the results of qualitative research emphasized meaning rather than generalizations. The research subjects in this study were Class VII Students of SMP Negeri 2 Langowan. In this study, researchers used several data collection procedures,

namely tests, as an assessment tool to obtain valid data. According to Sudjana (2014), tests as an assessment tool are questions given to students to get answers from students in oral, written or in the form of actions and interviews to communicate directly between researchers and respondents. The instruments used in this study were test questions (descriptions) and interviews.

RESULT AND DISCUSSION

This research was conducted at SMP Negeri 2 Langowan, addressed at Jln. Logos, Tounelet village, West Langowan, Minahasa, North Sulawesi Province. The research lasted approximately a week and was followed by 27 students consisting of 15 boys and 12 girls. In collecting research data, researchers used test questions to find out the mistakes made by students and interviews as a tool in completing research data collection. From the results of research at SMP Negeri 2 Langowan, the researchers obtained the following results:

Table 1. Percentage of Error Types

Problems	Reading Errors	Understanding Errors	Transformation Errors	Processing Skill Errors	Writing Final Answers
1	3	3	3	4	5
2	5	5	9	11	11
3	7	7	12	13	14
4	11	12	18	18	18
5	12	12	16	17	18
Total	38	39	58	63	66
Percentage	32,20%	33,05%	49,15%	53,35%	55,33%

Reading errors are finding keywords and reading the information and mathematical symbols in the questions. An example of a reading error is an error made by the subject (S-17). An example of this error can be seen in Figure 1 when working on question No. 1 below
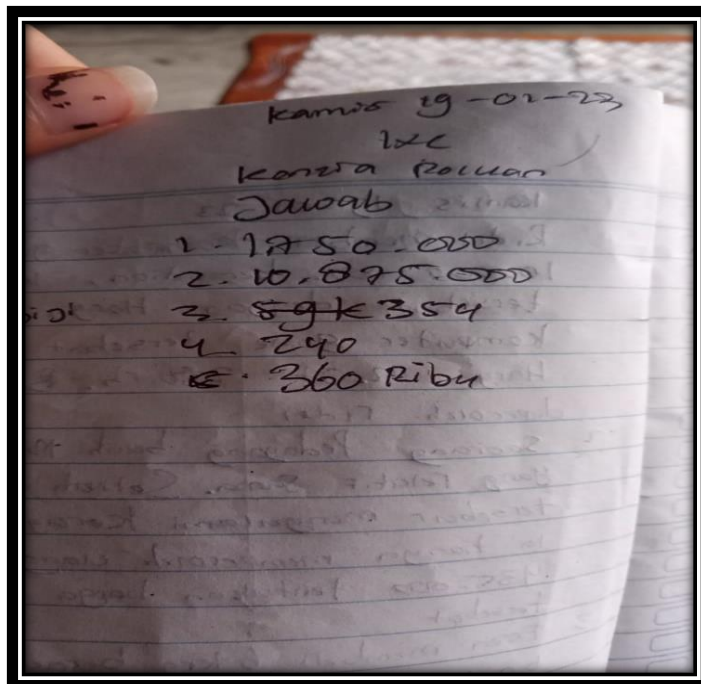
Figure 1. Students' Answers to Reading Errors

Results of interviews with KP students

Q : Why doesn't your answer use roads?

KP : To be honest, Sis, I don't know what to fill in because I find it difficult to understand the problem

Q : It's hard to understand how?

KP : I find it difficult to read and understand math problems in story form

Q : OK, thank you KP for your time

KP : You're welcome

Based on the interview results above, students made mistakes in the first stage of the Newman procedure, namely, reading errors. KP filled in the answers without using the road, which was also the result of cheating on friends because KP had difficulty reading and solving math problems in the form of word problems.

Understanding errors (Comprehension errors) is a lack of understanding of the problem so that students cannot determine what is known or what is being asked from the problem. An example of a misunderstanding is a mistake made by the subject (S-16). An example of this error can be seen in Figure 2 when working on question no. 5 below.
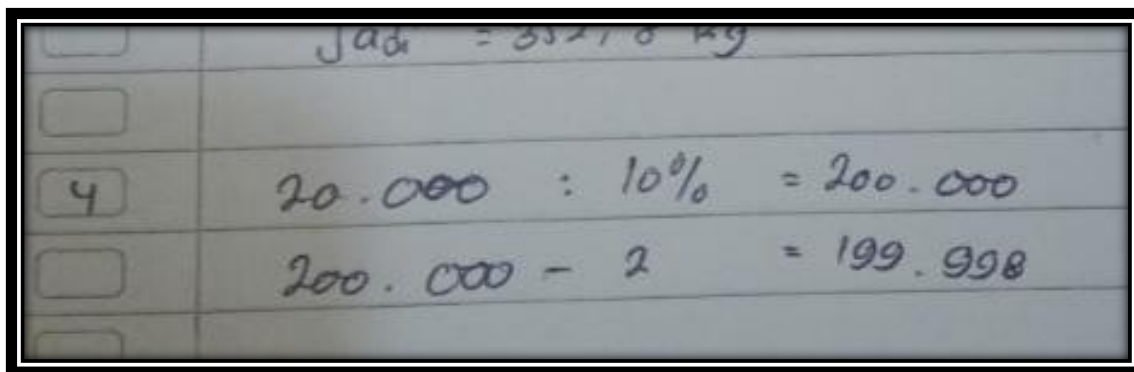
Figure 2. Students' Answers to Understanding Errors

Results of interviews with JS students

Q   : Try to explain how JS solves Problem number 5?

JS   : I only distribute the interest received divided by the interest at the bank

Q   : Then did sister JS reduce it by 2 months?
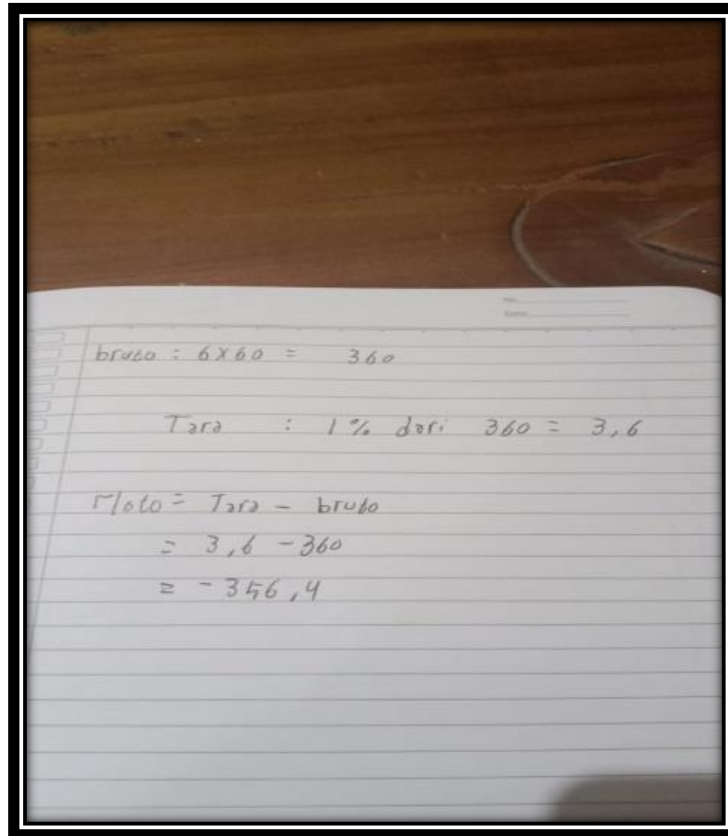
JS   : Yes, Sis, I reduced it by 2 months

Q   : OK, thank you JS for your time

JS   : You're welcome

Based on the interview results above, students made mistakes in the second stage of the Newman procedure, namely comprehension errors. JS does not write down what is known and asked in the questions, so JS only operates arbitrarily.

Transformation errors are errors in determining the formula used in the steps to solve the problem. An example of a transformation error is an error made by the subject (S-11). An example of an error can be seen in Figure 3 when working on question no. 3 below.

Figure 3. Student's Answers to Transformation Errors

Results of interviews with FK students

Q   : Try to explain how FK solves Problem number 3?

FK   : I'm looking for gross by multiplying 6x60 then looking for tare by taking 1% of the gross

Q   : Then do you use the net formula?

FK   : Yes, sis, I use the net formula, namely tare minus gross

Q   : Well, thank you FK for your time

FK   : You're welcome

Based on the interview results above, students made mistakes in the third stage of the Newman procedure, namely transformation errors. Because FK was wrong in determining the net formula, FK used the net formula, namely tare minus gross. It should be the other way around, gross minus tare.

Process skill errors are errors in determining the systematics of solving word problems and errors in operating calculations. An example of a skill error is a mistake

made by the subject (S-25). An example of an error can be seen in Figure 4 when working on question no. 4 below.

Figure 4 Student Answers Process Skills

Results of interviews with RT students

Q   : Try to explain how the younger siblings from the RT solved question number 3?

RT : First I multiply the 6 sacks and the weight of the 60 kg sacks, so I get the gross

Q   : Then the question?

RT : If the Tara is known to be 1%, then I will just change it to the form 1/100 then distribute

P   : OK, thank you, RT, for your time

RT : You're welcome

Based on the interview results above, students made mistakes in the fourth stage of the Newman procedure, namely Process skill errors, because RT does not operate 1% × 360 kg so you can get the difference.

Errors in Writing Final Answers (Encoding errors) are errors in determining the final answer or not determining the final answer. An example of a skill error is a mistake made by the subject (S-23). An example of an error can be seen in Figure 5 when working on question no. 5 below.
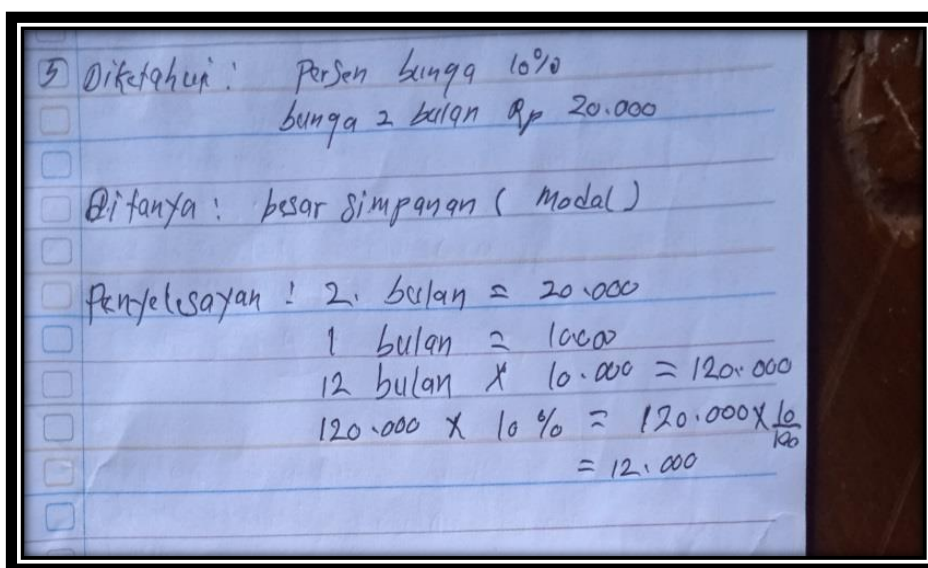

Figure 5 Student Answers Writing Errors in Final Answers

Results of interviews with RT students

Q   : Try to explain how the younger siblings from the RT solved question number 5?

RT   : Because it is known that 2 months is Rp. 20,000 so 1 month is Rp. 10,000 then I multiply it by 1 year

Q   : So your RT changed 1 year to 12 months?

RT   : Yes sis, I changed the year to month and then I multiplied it by 10%, so I got the result Rp.12,000

Q   : OK, thank you RT for your time

RT　: You're welcome

Based on the interview results above, students made mistakes in the fifth stage of the Newman procedure, namely Encoding errors. Because the RT did not use the formula, the RT did the wrong questions and got the wrong final answer.

CONCLUSION

Based on the results of research conducted in class IXC at SMP Negeri 2 Langowan, it can be concluded as follows: Of the five types of errors made based on the stages of the Newman procedure in solving word problems on social arithmetic material, the most frequent occurrence is an error in determining the final answer with a percentage of 55, 93%, process skill errors 53.38%, transformation errors 49.15%, 33.05% understanding errors, then 32.20% reading errors. The mistakes made by students in working on word problems on social arithmetic material were reading the story questions given and writing down what was known in the problem. Most students needed to learn what was being asked in the problem. Then students still need to understand social arithmetic material, are wrong in determining the mathematical model, are wrong in determining the right formula according to the problem and are wrong in determining the steps for solving related to social arithmetic questions. Hence, students still experience errors in arithmetic operations. The most frequent errors found that make students wrong is the process of solving questions so that in determining the final answer, students experience errors and do not write conclusions from the final answer.

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