Journal of Mathematics Education
Website: http://usnsj.id/index.php/JME
Email: pengelolajme@gmail.com
p-ISSN 2528-2468; e–ISSN 2528-2026

DOI: https://doi.org/10.31327/jme.v9i2.1985

ANALYSIS OF STUDENTS' ERRORS OF CLASS XI SMKN 2 PALU IN SOLVING MATRIX STORY PROBLEMS USING NEWMAN

Ni Luh Ermayanti*[1], Gandung Sugita[2], Alfisyahra[3], I Nyoman Murdiana[4]
[1)] Mahasiswa Program Studi Pendidikan Matematika, FKIP, Universitas Tadulako, Sulawesi Tengah
[2)3)4] Dosen Program Studi Pendidikan Matematika, FKIP, Universitas Tadulako, Sulawesi Tengah

Article Info

Article history:

Received Jul 04, 2023
Revised Aug 20, 2024
Accepted Nov 16, 2024

Keywords:

Error Analysis
Story Problems
Matrix
Newman Stages

ABSTRACT

The purpose of this study was to obtain a description of the mistakes made by class XI students of SMK Negeri 2 Palu in solving word problems on matrix material based on Newman's stages. The type of research used is qualitative research. The research design consists of planning, implementation and completion stages. The research subjects were 3 students of class XI at SMK Negeri 2 Palu. The results of this study indicate that DE subjects experienced errors at the stages of understanding the problem, the stage of transformation, the stage of processing skills, and the stage of writing the final answer. The HR subject experienced errors at the stage of transformation, stage of process skills and stage of writing the final answer. The RW subject experienced errors at the stages of understanding the problem, the transformation stage, the process skills stage, and the final answer writing stage. Therefore, it was concluded that all subjects did not experience errors in the question reading stage.

Corresponding Author:

Ni Luh Ermayanti,
Departement of Mathematics Education,
Universitas Tadulako Palu Sulawesi Tengah, Indonesia
Email: niluhermayanti20@gmail.com
Phone Number: 085256826650

How to Cite:

Ermayanti, Ni Luh., etc. (2024). Analysis of Students' Errors of Class XI SMKN 2 Palu in Solving Matrix Story Problems Using Newman. *JME:Journal of Mathematics Education*, 9(2), 168-183.

1. INTRODUCTION

Important skills possessed in this era of globalization include critical thinking skills, problem solving, creative thinking, collaboration and communication (Pratiwi, et al. 2019). These skills are known as high-level thinking skills or HOTS (High Order Thinking Skill). According to Suryapuspitarini, et al. (2019) HOTS are questions that require high-level thinking skills and involve reasoning processes, so that they can hone logical, critical,

reflective, metacognitive and creative thinking skills. The characteristics of HOTS-based questions are that they measure high-level thinking skills and are based on contextual problems (Setiawati, et al. 2018).

One of the subjects taught in schools that can be a tool to grow and develop high-level thinking skills is mathematics. This is in accordance with the opinion of Setiawati, et al. (2018) that mathematics is a science that can train students to think critically, systematically, logically, and creatively. Mathematics problems that require high-level thinking skills are story problems. According to Dwidarti (2019) there are still many students who have difficulty in solving mathematics problems, especially in the form of stories. This is because, in solving story problems, initial abilities are needed, namely: (1) The ability to read and understand questions, (2) The ability to determine what is known and asked in the question, (3) The ability to state questions in the form of mathematical models, (4) The ability to do calculations, and (5) The ability to write the final answer correctly (Widyaningrum, 2016). The difficulties experienced by these students can cause errors in solving questions and will have an impact on low student learning achievement. This is in accordance with the opinion of Limardani, et al. (2015) that the difficulties experienced by students can allow errors to occur in solving the test questions given.

One of the mathematical materials that can be presented in story-based questions is matrix material. Based on the results of the researcher's interview with one of the mathematics teachers at SMK Negeri 2 Palu on July 26, 2022, it was found that students' mathematics learning outcomes in matrix material were still low due to the lack of conceptual understanding that students had, especially in story problems. Students had difficulty understanding the meaning of the questions presented, so students often made mistakes in changing story problems into mathematical models. Students were also still wrong in presenting the form of the linear equation system obtained into a matrix. Students were also still wrong in determining the steps used in solving the problem. Furthermore, to obtain clear information as a follow-up to the results of the researcher's interview with the teacher, an identification test was conducted on 28 students regarding matrix material which was carried out on July 28, 2022. The questions given by the researcher to the students were as follows: Citra, Ani, and Diva went to the supermarket together. Citra bought 2 cans of milk and 4 packs of bread for Rp48,000.00. Meanwhile, Ani bought 3 cans of milk and 2 packs of bread for Rp44,000.00. If the price of a can of milk is x rupiah and the price of a pack of bread is y rupiah, determine: (1) The matrix form of the variables x and y, (2) The amount of money that Diva must pay if she buys 3 cans of milk and 5 packs of bread using the matrix inverse method.

Based on the results of the identification test, the results of the students' answers were obtained as in Figure 1, Figure 2, and Figure 3.

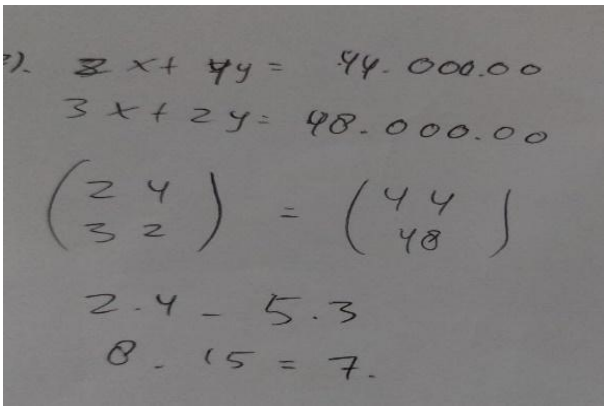

Figure 1. Student Answer 1

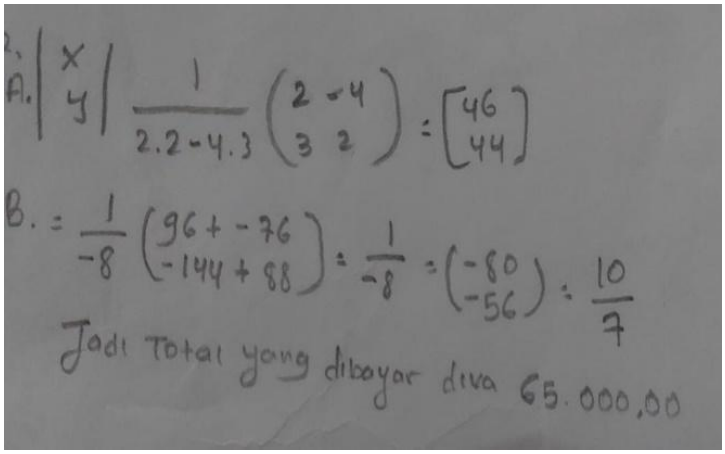

Figure 2. Student Answer 2

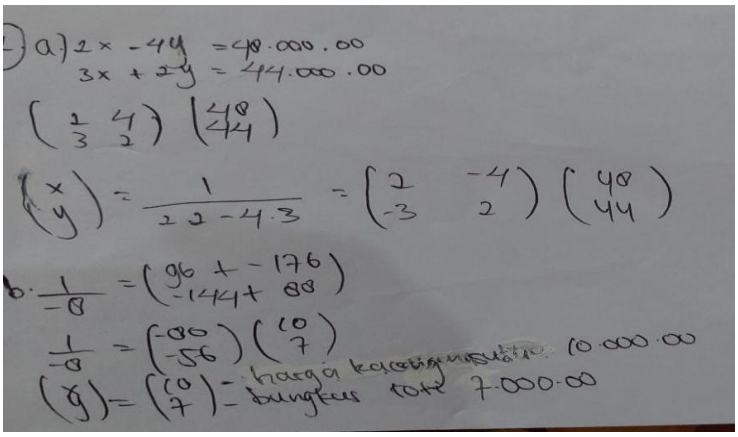

Figure 3. Student Answer 3

Based on the students' answers above, it was found that the mistakes made by students in solving the questions were that students did not write down what was known and asked, were wrong in changing the information in the questions into mathematical models, were wrong in determining formulas and operations, were wrong in making calculations, did not write down the steps for solving completely, were unable to continue the solving procedure so that they were wrong and could not write conclusions or final answers. So it can be concluded that in the matrix material, students still make many mistakes. Therefore, an effort needs to be made to analyze students' mistakes in solving matrix story problems. This is in accordance with the opinion of Nurussafa'at, et al. (2016) that the mistakes made by students need to be analyzed further, in order to obtain clear and detailed information regarding students' weaknesses in solving story problems. Information regarding the mistakes made by students can be used as a consideration for teachers in designing teaching and learning activities and determining alternative learning that can be used to reduce the occurrence of the same mistakes.

The errors that occur in students in solving story problems can be analyzed using Newman's stages. Newman stated that errors in solving mathematical story problems are divided into five types of errors, namely: 1) Reading errors, 2) Comprehension errors, 3) Transformation errors, 4) Process skill errors, 5) Encoding errors (Karnasih, 2015).

Based on the description above, the researcher is interested in conducting a study entitled "Analysis of Student Errors in Solving Story Problems on Matrix Material in Class XI of SMK Negeri 2 Palu Based on Newman's Stages".

2. METHOD

The type of research used in this study is descriptive qualitative research. The place and time of the research were conducted at SMK Negeri 2 Palu in the even semester. The subjects of the study were 3 students of class XI SMK Negeri 2 Palu. The selection of subjects in this study was based on several considerations, namely (a) students who make the most mistakes, (b) have different mistakes, (c) Mistakes can represent mistakes made by other students, (d) The student has good communication skills, (e) The willingness of students to be subjects, and (f) Recommendations from the mathematics teacher of SMK Negeri 2 Palu. The research instruments used in this study were the main instrument, namely the researcher himself, and the supporting instruments, namely written assignments and interview guidelines. Data collection techniques used in this study were written assignments and interviews. Data credibility testing used time triangulation. Time triangulation is a credibility testing technique by obtaining data from the same source at different times. If there is a difference in information or answers given by the subject regarding the stage of solving the problem, then the test is carried out again until a consistent answer is obtained. The data analysis technique in this study was carried out by referring to the qualitative data analysis model of Miles et al., (2014), namely data condensation (Data Condensation), data presentation (Data Display), and Conclusion/Verification (Drawing and Verifying Conclusion). The following table presents the indicators of Newman's stage errors:

Table 2.1 Newman Stage Error Indicators

Error Type	Indicator
1. Reading errors	a. Cannot read words, units, mathematical symbols or important information in the problem.
2. Comprehension error	a. Not writing down what is known and asked by the question. b. Wrong in writing what is known and asked in the question. c. It is not complete to write what is known and asked from the question.
3. Transformations errors	a. Failure to convert information in the problem into a mathematical model. b. Wrong in determining the method, formula, or operation used in solving the problem.
4. Process skill errors	a. Mistakes in calculations and the rules to be used. b. Wrong in determining the steps used in solving the problem. c. Incomplete in writing the steps used in solving

	the problem. d. Cannot continue the completion procedure.
5. Encoding errors	a. Not writing the final answer or conclusion as requested by the question. b. Inaccurate/incomplete in writing the final answer or conclusion. c. Wrong in writing the final answer or conclusion.

3. RESULTS AND DISCUSSION

3.1. Results

The subjects of this study were 3 students out of 27 students of class XI OTKP 4 SMK Negeri 2 Palu. The students were given a written assignment about story problems on matrix material totaling 1 question. Based on the mistakes made by students in solving the questions, 3 students were selected, namely students number 7, 10 and 28 as research subjects. The reason the researcher chose these students was because the three students made the most mistakes, had different mistakes, mistakes could represent mistakes made by other students, had good communication skills, student willingness, and recommendations from mathematics teachers at the school. The three subjects were DE student number 7, HR student number 10, and RW student number 28.

3.2. Discussion

The results obtained in this study are the errors made by students in solving story problems on matrix material based on Newman's stages. The following are the results of the written assignment of the DE subject in Figure 1.

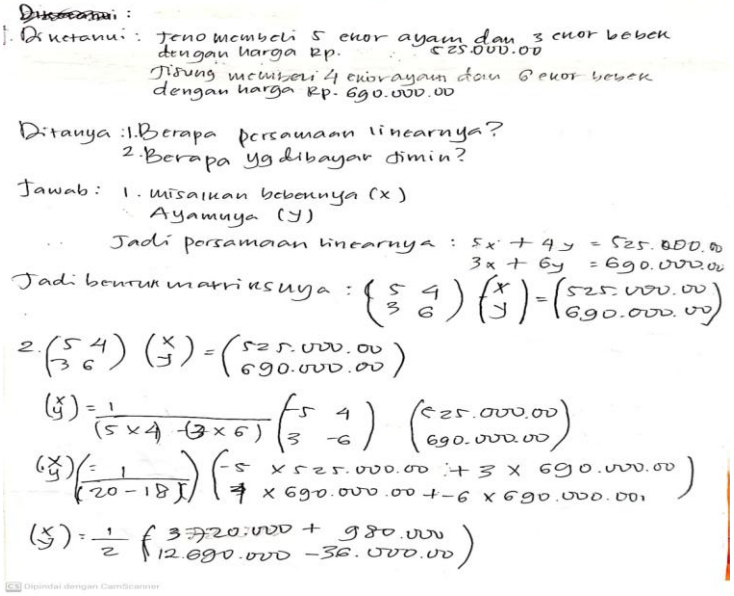

Figure 4. Answers to DE Written Assignment

Based on the results of DE's written assignments in Figure 4, it can be seen that DE can write down the information known in the question correctly but DE is incomplete in

writing down the information asked in the question (DE1 01). Furthermore, DE is wrong in writing the linear equation system or mathematical model of the question (DE1 02) and is wrong in determining the formula used to solve the question (DE1 03, DE1 04). Then DE is wrong in doing the calculation (DE1 05). In addition, DE also does not write the final answer or conclusion.

T1PN07 : Now, try reading question number 1.
T1DE08 : (reads the question
T1PN09 : {-} Do you understand what the question means?
T1DE10 : {-} Here, Jeno buys 5 chickens and 3 ducks for Rp525,000.00, and then Jisung buys 4 chickens and 6 ducks for Rp690,000.00.
T1PN11 : Is that all?
T1DE12 : {…} Jimin also buys 5 chickens and 6 ducks, but we don't know the price yet.
T1PN13 : Can you mention what symbols are in the question?
T1DE14 : Rupiah sis
T1PN15 : What does the rupiah symbol in the question represent?
T1DE16 : Currency, like the price of the chickens and ducks.
T1PN17 : {-} What information is given in the question?
T1DE18 : {-} Jeno buys 5 chickens and 3 ducks for Rp525,000.00, while Jisung buys 4 chickens and 6 ducks for Rp690,000.00.
T1PN19 : {-} What is asked in the question?
T1DE20 : First, what are the linear equations, and second, how much did Jimin pay?
T1PN21 : Is that all?
T1DE22 : {…} Yes, sis.
T1PN23 : And for the matrix form?
T1DE24 : {…} I forgot, sis.
T1PN25 : Now, can you explain how to solve this question?
T1DE26 : First, let's assign x to ducks and y to chickens, then make the linear equations and matrix form. For the second part, we use the matrix inverse method.
T1PN27 : For the first part, are you assigning x and y to the number of chickens and ducks, or the price per chicken and duck?
T1DE28 : As far as I know, it's the chickens and ducks, sis.
T1PN29 : Can you explain how to obtain the mathematical model as you wrote?
T1DE30 : After assigning xxx to ducks and yyy to chickens, we make the linear equations, combining chickens with chickens and ducks with ducks. So, we get $5x + 4y = 525.000$ and $3x + 6y = 690.000$
T1PN31 : And for the matrix form?
T1DE32 : Just take the numbers and write them in parentheses.
T1PN33 : For the second part, which uses the matrix method, do you understand the inverse method?
T1DE34 : {…} Only a little, sis.
T1PN35 : What is the formula for the matrix inverse method?
T1DE36 : {…} One over the determinant times the adjoint.
T1PN37 : Now, try explaining the steps to solve this question until you get the result as you wrote.
T1DE38 : Write it down first $\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{(5\times4)-(3\times6)} = \begin{pmatrix} -5 & 4 \\ 3 & -6 \end{pmatrix} \begin{pmatrix} 525.000 \\ 690.000 \end{pmatrix}$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{20-18} = \begin{pmatrix} -5 \times 525.000 + 3 \times 690.000 \\ 4 \times 690.000 + (-6) \times 690.000 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{2} \begin{pmatrix} 3.720.000 + 980.000 \\ 12.690.00 - 36.000.00 \end{pmatrix}$$

T1PN39 : For these second and third steps, are you sure your calculations are correct?
T1DE40 : I don't know, sis. I think so.
T1PN41 : Do you remember the formula for the determinant and matrix multiplication?
T1DE42 : {…} I forgot, sis.
T1PN43 : Are you sure about the multiplication result? For example, here $(-6) \times 690.000$, Are you sure this result is 36.000.00?
T1DE44 : {…} I think I miscalculated, sis.
T1PN45 : Why did you miscalculate?
T1DE46 : I rushed through it yesterday, so I miscalculated.
T1PN47 : Are these the only steps you took to solve the question?
T1DE48 : Yes, that's all I know, sis.
T1PN49 : So what is your conclusion from this answer?
T1DE50 : {…} I don't have a conclusion, sis, because I don't know how to finish it completely.

Based on the interview results above, it was obtained that DE was able to read the questions correctly (T1DE08), DE also knew and was able to explain the meaning of the questions (T1DE10), was able to determine the symbols and important information contained in the questions (T1DE12, T1DE14, T1DE16). Then DE was able to mention the information known from the questions correctly (T1DE18) and DE was unable to mention all the information asked in the questions (T1DE20, T1DE22, T1DE24). Furthermore, DE knew the steps used to solve the questions (T1DE26). However, DE was wrong in creating a linear equation system or mathematical model so that the matrix form obtained was also wrong (T1DE30, T1DE32) and DE was wrong in determining the formula used to solve the questions (T1DE36, T1DE38, T1DE40, T1DE42) this is because DE does not know the determinant formula and matrix multiplication. Then DE made a wrong calculation (T1DE44, T1DE46) this is because when calculating DE was in a hurry and not careful so that the results obtained were wrong. DE also could not continue the solution procedure (T1DE48) because he did not know the next step to solve the problem. In addition, DE also could not write the final answer or conclusion. This is because he could not continue the solution procedure, so he did not get the final answer or conclusion (T1DE50).

Based on the results of HR's written assignments in Figure 5, it can be seen that HR can write down the information known in the question correctly but HR is incomplete in writing down the information asked in the question (HR1 01). Furthermore, HR does not write down the linear equation or mathematical model of the question (HR1 02) and is wrong in determining the formula used to solve the question (HR1 03). Then HR is wrong in making calculations (HR1 04), HR is wrong in determining the steps used in solving the question (HR1 05). In addition, HR is also wrong in writing the final answer or conclusion (HR1 06).

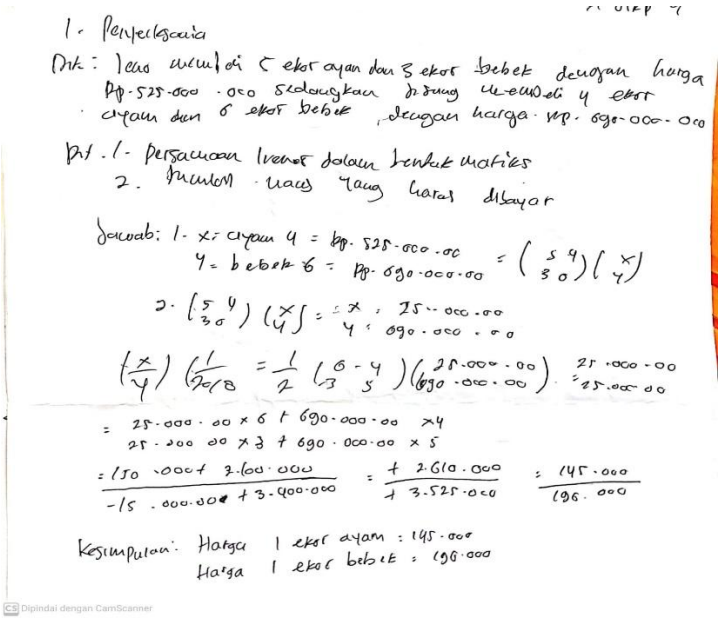

Figure 5. Answers to HR Written Assignments

T1PN07 : Now try reading question no.1
T1HR08 : (reading the question)
T1PN09 : {-} Do you understand what the question means?
T1HR10 : {…} I only understand a little, sis
T1PN11 : So what important information did you get from the question?
T1HR12 : {…} eno has 5 chickens, oh no, sis Jeno bought 5 chickens and 3 ducks for Rp525.000,00 then Jisung bought 4 chickens and 6 ducks for Rp690.000,00.
T1PN13 : Is that all? Is there any other information?
T1HR14 : {…} Jimin also bought 5 chickens and 6 ducks but the prices are not yet available.
T1PN15 : Can you mention the symbols in the question?
T1HR16 : {…} rupiah symbol sis
T1PN17 : What does the rupiah symbol in this question indicate, sis?
T1HR18 : Price of chicken and duck
T1PN19 : {-} what is known from the question?
T1HR20 : {…} Jeno bought 5 chickens and 3 ducks for Rp525,000.00 while Jisung bought 4 chickens and 6 ducks for Rp690,000.00.
T1PN21 : {-} then what is asked in the question?
T1HR22 : {…} the first, linear equations in matrix form then the second, the amount of money that must be paid
T1PN23 : Do you understand what you wrote? Can you explain a little what is meant by that?
T1HR24 : {…} the first is to determine the system of linear equations that can be arranged from the problem above, then converted into matrix form. Second, determine the amount of money that Jimin must pay if he buys 5 chickens and 6 ducks using the matrix inverse method.
T1PN25 : So what is the question asking?

T1HR26 : First, the linear equation system is then converted into a matrix form, then second, the amount of money that Jimin must pay if he buys 5 chickens and 6 ducks using the matrix inverse method.
T1PN27 : Then, why don't you write it completely like you said earlier?
T1HR28 : {…} it's very long, so I'll just write it briefly hehehe
T1PN29 : {-} Now can you explain how to solve this question?
T1HR30 : {…} x is the same as chicken, y is duck {…}
T1PN31 : So what?
T1HR32 : {…} I don't know anymore, bro
T1PN33 : ou don't know how to make an equation or mathematical model? For example, like $x + 5 = 5.000$ for example
T1HR34 : I'm confused, so I don't know
T1PN41 : {-} now how do you solve the second one?
T1HR42 : Using the matrix inverse method, right?
T1PN43 : What is the formula for the matrix inverse method?
T1HR44 : {…} one per determinant multiplied by the one that is swapped.
T1PN45 : What do you mean swapped?
T1HR46 : This one, (while pointing to the answer) 6 with 5 is swapped and 3 with 4 has a negative.
T1PN47 : Then where does this 20-18 come from?
T1HR48 : The determinant result, sis, is from $5 \times 4 - 3 \times 6$
T1PN49 : Are you sure the formula for finding the determinant is correct?
T1HR50 : {…} As I recall, that's it, sis
T1PN55 : Can you explain how to multiply and add
T1HR56 : Yang baris kolom ini kak, ini 6 dik This row and column, sis, this is 6 times ali 25.000, -4 times 695.000 ehh.. -4 times 690.000, -3 times 25.000, then 5 times 690.000
T1PN57 : So what?
T1HR58 : {…} write the result of the multiplication, sis, then add it up, eee but here it's wrong, sis, it should be 525,000, not 25,000. So the answer is wrong, sis
T1PN59 : Are you sure the result is $690.000 \times 4 = -2.100.000$ and this one is also $25.000 \times 3 = 15.000{,}00$
T1HR60 : {…} I miscalculated, sis
T1PN61 : How could I miscalculate?
T1HR62 : I quickly calculated it yesterday, sis, so I guess I got the result
T1PN63 : Then where did you get the 145,000 and 196,000 from?
T1HR64 : {…} I divided each by 18 if I'm not mistaken, sis
T1PN65 : How could it be divided by 18, where did the 18 come from?
T1HR66 : I just divided it randomly, sis, so the result wouldn't be millions
T1PN67 : So the solution to this question only goes as far as this?
T1HR68 : As far as I know, that's all, bro.
T1PN69 : Okay, so what's the conclusion of your answer, bro?
T1HR70 : The price of 1 chicken is the same as 145,000 and 1 duck is 196,000
T1PN71 : The price of 1 chicken is the same as 145,000 and 1 duck is 196,000
T1HR72 : {…} no, bro, it should be the amount of money paid by Jimin
T1PN73 : So how do you calculate the amount of money that Jimin has to pay?
T1HR74 : {…} I don't know, bro, I only understand that much.

Based on the interview results above, it was obtained that HR was able to read the questions correctly (T1HR08), HR was also able to explain the meaning of the questions, was able to determine the symbols and important information contained in the questions (T1HR12, T1HR14, T1HR16, T1HR18). Then HR was able to mention what information was known in the questions correctly (T1HR20) and HR was able to mention all the information asked in the questions by reading the questions repeatedly (T1HR24, T1HR26). HR knew all the information asked in the questions, but on the answer sheet HR wrote it briefly (T1HR28). Furthermore, HR could not mention the linear equation system or its mathematical model (T1HR34). HR was able to mention the formula that would be used to solve the questions (T1HR44, T1HR46), but HR was wrong in determining the determinant formula (T1HR48). Then HR was not careful in writing the information contained in the question (T1HR56, T1HR58), HR made a mistake in calculating because it was too hasty and not careful so that the results obtained were wrong (T1HR60, T1HR62), HR made a mistake in determining the steps in solving the question by simplifying the results obtained so that they were not worth millions (T1HR64, T1HR66), and HR could not continue the completion procedure to the end (T1HR68). In addition, HR was also wrong in writing the final answer or conclusion because it could not continue the completion procedure to the end (T1HR72, T1HR74).

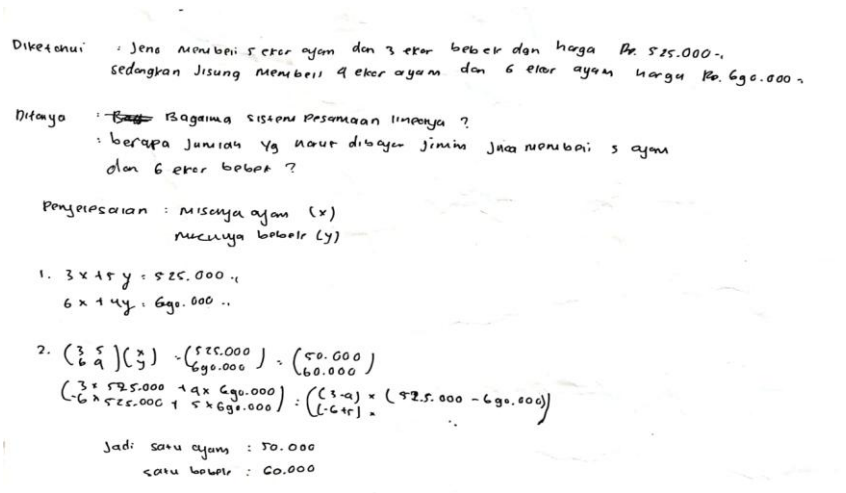

Figure 6. Answers to RW Written Assignments

Based on the results of RW's written assignments in Figure 6, it can be seen that RW can write down the information known in the question correctly but RW is incomplete in writing down the information asked in the question (RW1 01). Then RW is wrong in writing the linear equation system or mathematical model of the question (RW1 02) and does not create the matrix form and is wrong in determining the formula used to solve the question (RW1 03). Furthermore, RW is wrong in using the rules of operation (RW1 04) and is wrong in determining the steps in solving the question. In addition, RW is wrong in writing the final answer or conclusion (RW1 05).

T1PN07 : Now try reading question no.1
T1RW08 : (reading the question)
T1PN09 : {-} Do you understand what the question means?
T1RW10 : Got it sis
T1PN11 : So what important information did you get from the question?
T1RW12 : {…} Jeno bought 5 chickens and 3 ducks for Rp525,000.00 then {…} Jisung bought 4 chickens and 6 ducks for Rp690,000.00.

T1PN13 : Is that all?
T1RW14 : {…} I'll use the inverse method later sis.
T1PN15 : {-} Now can you mention what symbols are in the question?
T1RW16 : Rupiah sis
T1PN17 : What does the rupiah symbol in the question indicate?
T1RW18 : Price of chickens and ducks sis.
T1PN19 : {-} what is known from the question?
T1RW20 : Jeno bought 5 chickens and 3 ducks for Rp525,000.00. While Jisung bought 4 chickens and 6 ducks for Rp690,000.00.
T1PN21 : {-} then what is asked in the question?
T1RW22 : First, what is the linear equation and second, how much money should Jimin pay if he buys 5 chickens and 6 ducks.
T1PN23 : Is that all?
T1RW24 : {…} yes sis, that's all I know
T1PN25 : What about the matrix form?
T1RW26 : {…} I think that's all sis
T1PN27 : Now can you explain how to solve this question?
T1RW28 : {…} if for example the chicken is x and the duck is y
T1PN29 : Okay, this is what you assume is chicken with duck or the price of 1 chicken and 1 duck?
T1RW30 : {…} chicken with duck sis.
T1PN31 : Can you explain how to get the mathematical model as you wrote?
T1RW32 : Suppose the chicken is x and the duck is y, then the equation is made so $3x + 5y = 525.000$ and $6x + 4y = 690.000$
T1PN33 : How did you get $3x + 5y = 525.000$ and $6x + 4y = 690.000$?
T1RW34 : {…} he chicken is x, eee then jeno bought 5 chickens so {…} So.. 5 {…} this is the wrong answer sis.
T1PN35 : Wrong how?
T1RW36 : I saw it wrong, sis, the x and y are reversed
T1PN37 : What about the matrix form earlier?
T1RW38 : {…} I don't know sis
T1PN39 : {-} for the second one, how do you solve it?
T1RW40 : Using the matrix inverse method sis
T1PN41 : What method?
T1RW42 : {?}
T1PN43 : Inverse?
T1RW44 : Yes, that's it
T1PN45 ; Do you understand the steps of the matrix inverse method?.
T1RW46 : {…} I forgot how it works too sis.
T1PN47 : Forgot or don't know?
T1RW48 : Both sis, I don't know how to do it sis.
T1PN49 : So what method did you use to write this?
T1RW50 : {-} I just randomly wrote it sis
T1PN51 : For this (pointing to the student's answer) why is it here $(3 - 4) \times (525.000 - 690.000)$ then $-6 + 5$ multiplied by what here?
T1RW52 : I'll just write this briefly, here $(-6 + 5) \times (525.000 - 690.000)$. then to make it easier to calculate, I'll just add it up like that, then multiply it later.
T1PN53 : Isn't it true that in the rules of operations, multiplication or division is prioritized first, then addition or subtraction?

T1RW54 : {…} I think it could be like that, sis
T1PN55 : So the steps you took to solve this problem only got to this point?
T1RW56 : Yes, it only got to that point, sis
T1PN57 : Why didn't you continue until the end?
T1RW58 : I don't know sis, I only know up to that point sis
T1PN59 : So what is the conclusion of your answer sis?
T1RW60 : The price of one chicken is 50,000 while the price of one duck is 60,000
T1PN61 : So how did you come to that conclusion? I didn't know how to do it earlier
T1RW62 : As far as I know, that's the price of chicken and duck that I've bought at the market sis (laughing)

Based on the interview results above, it was obtained that RW was able to read the questions correctly (T1RW08), RW was also able to explain the meaning of the questions, was able to determine the symbols and important information contained in the questions (T1RW12, T1RW14, T1RW16, T1RW18). Then RW was able to mention what information was known in the questions correctly (T1RW20) and RW was unable to mention all the information asked in the questions (T1RW22, T1RW24, T1RW26). Furthermore, RW was wrong in the mathematical model of the question (T1RW32) because RW was not careful in reading the information contained in the questions (T1RW34, T1RW36). RW did not know how to change the linear equation system into matrix form so that RW did not write the matrix form of the linear equation system obtained (T1RW38), and RW was also wrong in determining the formula to solve the question because he did not know the matrix inverse method formula (T1RW48, T1RW50). Then RW was wrong in using the operating rules. This was done by RW to make the calculation easier (T1RW52), where multiplication or division operations should be prioritized then addition or subtraction operations. RW also could not continue the solution procedure (T1RW56) because he did not know the next step to solve the problem (T1RW58). In addition, RW was wrong in writing the final answer. This is because RW was unable to continue the solution procedure to the final stage, so RW only guessed the price of one chicken and duck (T1RW62).

Based on the presentation of the research results, it was found that the errors made by students according to Newman's error analysis method by the three research subjects were as follows.

Subject DE can read the questions correctly, understand the meaning of the questions, and is able to determine the symbols and important information contained in the questions correctly. So it can be concluded that the subject did not experience reading errors, this is in line with Asmarani's opinion (2016) that students can read questions correctly without any errors in pronunciation. At the stage of understanding the problem, subject DE is incomplete in expressing all the information asked in the question. The cause of the error is because the subject does not understand the question well and is not careful when reading the question. This is in line with the opinion of Mubarok & Dewi (2021) that errors in understanding questions occur because students do not understand the material well, students' inaccuracy when reading questions and are not used to writing are known and asked. At the transformation stage, subject DE made a mistake in making a mathematical model of the question and had problems determining the formula used to solve the question because they did not know the determinant formula and matrix multiplication. This is in line with Malik's opinion (2017) that students do not understand the question and are weak in the concept of variables so that they make wrong analogies and are unable to translate the question sentence into a sentence or mathematical model. Meanwhile, Puspitasari &

Zulkarnaen (2021) stated that in applying the formula used, students usually do not read the questions properly so that they are less precise and give students errors at the transformation stage. At the process skills stage, DE subjects made mistakes in calculating and were unable to continue the research procedure due to errors in the previous stage. Errors at the process skills stage are mostly caused by errors in the previous stage and not a few students are able to determine arithmetic operations but do not know the steps to be used to solve the problem correctly so that many students do not continue the solution procedure until completion (Amin, et al. 2021). At the stage of writing the final answer, DE subjects were unable to write and express conclusions or final answers according to the question request because they were unable to work on the questions properly according to the problem solving procedure. This is in line with the opinion of Amin, et al. (2021) that the mistakes made by students at the stage of writing the final answer were: students were unable to find the final result of the question correctly and students were unable to show the final answer correctly and were unable to write the final answer according to the conclusion.

Subject HR can read the questions correctly, understand the meaning of the questions, and is able to determine the symbols and important information contained in the questions correctly. So it can be concluded that the subject did not experience reading errors, this is in line with Asmarani's opinion (2016) that students can read questions correctly without any errors in pronunciation. At the stage of understanding the problem, subject HR can express all the information that is known and what is asked in the question completely, even though the subject is not complete in writing the information that is asked on the answer sheet. This is in line with Yanti's opinion (2017) that students are not careful, in a hurry and forgetful so that in writing what is known and what is asked it is still not quite right or not appropriate. At the transformation stage, subject HR was unable to write and mention the mathematical model of the question and had problems in determining the formula used to solve the question. Students are not used to and lack experience in solving problems in the form of stories so they are not trained in making mathematical models. This is in line with the opinion of Shinariko, et al. (2020) that mistakes made by students at the transformation stage occur when students are able to understand the meaning of the question but cannot change the question into mathematical form correctly or fail to choose the right mathematical strategy to solve the question. At the process skills stage, HR subjects made mistakes in calculating, made mistakes in determining the steps to solve the problem, and were unable to continue the research procedure due to errors in the previous stage. Lack of practice and students' carelessness in working on the problem and rushing to do the calculations resulted in incorrect results. In addition, students' lack of understanding in determining the formula or procedure for solving the problem at the previous stage caused students to make mistakes in carrying out the steps to solve the problem, which affected the final answer. Process skills errors occur because students feel confused when determining the steps to solve it, students also said that they were not used to or had little experience in solving problems in the form of stories (Nurfalah, et al. 2021). At the stage of writing the final answer, HR subjects made mistakes in writing and expressing conclusions or final answers according to the question request because they were unable to work on the problem properly according to the problem solving procedure and there had been errors in the previous stages. This is in line with the opinion of Mubarok & Dewi (2021) that students are able to draw conclusions from the answers, but they are not quite right.

Subject RW can read the questions correctly, understand the meaning of the questions, and is able to determine the symbols and important information contained in the questions correctly. So it can be concluded that the subject did not make any reading errors, this is in line with Asmarani's opinion (2016) that students can read questions correctly

without any errors in pronunciation. At the stage of understanding the problem, subject RW was incomplete in expressing all the information asked in the question. This happened because the subject did not understand the questions well and was not careful when reading the questions. This is in line with Zulyanty's opinion (2019) that the mistakes made by students at this stage are characterized by students being unable to identify what information is known and what is asked in the questions correctly, so that students are wrong in solving the questions or cannot find the right solution. At the transformation stage, subject RW was less careful in reading the information contained in the questions so that he made a mistake in making his mathematical model and did not know what formula to use to solve the questions. Subject RW solved the questions by multiplying any numbers he obtained. This is in line with the opinion of Yusnia & Fitriyani (2017) who argue that errors that occur at the transformation stage occur when students cannot write or state the formula according to the question request. At the process skills stage, subject RW made a mistake in using the operating rules and could not continue the research procedure due to errors in the previous stage. Errors at the process skills stage that occur in students are not being able to write the process of working on the problem and the appropriate arithmetic operations (Qoiriyah, et al. 2021). At the stage of writing the final answer, subject RW made a mistake in writing and expressing the conclusion or final answer according to the question request because he was unable to work on the problem properly according to the problem solving procedure. Students make mistakes at the stage of writing the final answer due to errors in the previous stage and students are not careful in understanding the problems in the question (Cahrianto, et al. 2020).

4. CONCLUSION

Based on the research results and discussion, the following conclusions were obtained:

Subject DE did not make any errors at the reading question stage, because the subject could read the question correctly and knew the intent and important information of the question. Subject DE made an error at the understanding problem stage, because the subject was incomplete in writing and stating all the information asked in the question. Subject DE made an error at the transformation stage, because the subject made an error in creating a mathematical model of the question and made an error in determining the formula used to solve the question. Subject DE made an error at the process skills stage, because the subject made an error in calculating and could not continue the research procedure. Subject DE made an error at the final answer writing stage, because the subject could not write and express the conclusion or final answer.

Subject HR did not make any errors at the reading question stage, because the subject could read the question correctly and knew the intent and important information of the question. Subject HR did not make any errors at the understanding problem stage, because the subject could express all the information known and asked in the question completely. Subject HR made an error at the transformation stage, because the subject was unable to create a mathematical model of the question and had problems determining the formula used to solve the question. Subject HR made an error at the process skills stage, because the subject made a mistake in calculating, made a mistake in determining the steps in solving the question and could not continue the research procedure. Subject HR made an error at the final answer writing stage, because the subject made a mistake in writing and expressing the conclusion or final answer.

Subject RW did not make any errors at the reading question stage, because the subject could read the question correctly and knew the intent and important information of

the question. Subject RW made an error at the understanding problem stage, because the subject was incomplete in writing and stating all the information asked in the question. Subject RW made an error at the transformation stage, because the subject made a mistake in creating a mathematical model of the question and did not know the formula to be used to solve the question. Subject RW made an error at the process skills stage, because the subject made a mistake in using the operating rules and could not continue the research procedure. Subject RW made an error at the final answer writing stage, because the subject made a mistake in writing and expressing the conclusion or final answer.

Based on the research that has been discussed and concluded regarding the many errors that occur in students in solving story problems on matrix material, the suggestions recommended by the researcher are:

For mathematics teachers, it is expected to routinely provide contextual problems so that they are trained in solving mathematical problems related to everyday life, and to accustom students to solving problems with complete solution steps such as reading carefully, writing down what information is known and asked completely, writing down the formula used and writing the final answer. In addition, teachers can design the right solution to be used in the learning process so that similar mistakes are not repeated in solving matrix material story problems.

For students, it is expected to be more careful and careful in solving problems, especially when doing calculations in order to reduce errors or mistakes. In addition, students should increase their practice in solving story problems, especially matrix materials, so that they are accustomed to taking steps to solve problems.

It is hoped that other researchers can conduct further research on the factors that cause students' errors in solving story problems on matrix material.

REFERENCES

Amin, K., Kamid, & Hariyadi, B. (2021). Error Analysis in Solving Contextual Mathematics Problems on Flat-Sided Space Material Based on Newman Error Analysis Reviewed from Gender. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *5*(2), 2053–2064.

Asmarani, A. D. (2016). Analysis of Students' Errors in Grade VII of Aloysius Turi Junior High School in the Academic Year of 2015/2016 in Solving Mathematical Story Problems on the Topic of Integers Based on the Newman Error Analysis Method. Thesis, Sanata Dharma University. Yogyakarta.

Dwidarti, U., Mampouw, H. L., & Setyadi, D. (2019). Analysis of Difficulties in Solving Story Problems on Set Material. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 3*(2), 315-322

Karnasih, I. (2015). Newman's Error Analysis in Mathematical Story Problems. *Jurnal PARADIKMA*, *8*(1l), 37–51.

Limardani, G., Trapsilasiwi, D., & Fatahillah, A. (2015). Analysis of Students' Difficulties in Solving Algebraic Operation Problems in Class VIII D Students of SMP Negeri 4 Jember. *Student Scientific Articles*, *1*(1), 1–7

Malik, A. (2017). Analysis of Errors in Solving Two-Variable Linear Equation System Story Problems (SPLDV) in Grade VIII Students of SMP Negeri 1 Orong Telu. Thesis, Postgraduate Program, Open University. Jakarta.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook*. Sage: London.

Mubarok, A., & Dewi, E. Y. (2021). Analysis of Junior High School Students' Errors in Solving Critical Thinking Skills Problems Based on Newman. *Jurnal Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika*, *2*(1), 121–135.

Nurfalah, I. A., Novtiar, C., & Rohaeti, E. E. (2021). Analysis of Student Errors Based on Newman's Categories in Solving Problems on Function Material. *JPMI: Journal of Innovative Mathematics Learning*, *4*(1), 205–214.

Nurussafa'at, F. A., Sujadi, I., & Riyadi. (2016). Analysis of Students' Errors in Solving Story Problems on Prism Volume Material with Fong's Schematic Model for Error Analysis Reviewed from Students' Cognitive Style (Case Study of Grade VIII Students Semester II of SMP IT Ibnu Abbas Klaten in the 2013/2014 Academic Year. Electronic Journal of Mathematics Learning, *4*(2), 174–187.

Pratiwi, N. P. W., Dewi, N. L. P. E. S., & Paramartha, A. A. G. Y. (2019). The Reflection of HOTS in EFL Teachers' Summative Assessment. *Journal of Educational Research and Evaluation*, *3*(3), 127.

Puspitasari, M., & Zulkarnaen, R. (2021). Analysis of Grade VII Students' Errors in Solving Story Problems Based on Newman's Theory Reviewed from the Aspects of Problem Representation and Solution Execution. *JPMI: Journal of Innovative Mathematics Learning*, *4*(3), 609–618.

Qoiriyah, N., Susilo, D. A., & Hariyani, S. (2021). Analysis of Students' Errors in Solving Story Problems Based on Newman's Procedure. *Sigma*, *6*(2), 156

Setiawati, W., Asmira, O., Ariyana, Y., Bestary, R., & Pudjiastuti, A. (2018). Higher Order Thinking Skills Oriented Assessment Book: Zoning-Based Learning Competency Improvement Program. *Directorate General of Teachers and Education Personnel, Ministry of Education and Culture*.

Shinariko, L. J., Saputri, N. W., Hartono, Y., & Araiku, J. (2020). Analysis of students' mistakes in solving mathematics olympiad problems. *Journal of Physics: Conference Series*, *1480*(1), 012039.

Suryapuspitarini, B. K., Wardono, & Kartono. (2018). Analysis of Higher Order Thinking Skill (HOTS) Type Mathematics Questions in the 2013 Curriculum to Support Students' Literacy Skills. *Prisma, Proceedings of the National Mathematics Seminar,* 876–884.

Widyaningrum, A. Z. (2016). Analysis of Students' Difficulties in Working on Mathematical Story Problems on Social Arithmetic Material Reviewed from the Learning Styles of Grade VII Students of SMP Negeri 5 Metro in the 2015/2016 Academic Year. *Journal of Educational Science Studies*, *1*(2), 165–190.

Yanti, A. F. (2017). Analysis of Grade X Students' Errors in Solving Mathematical Logic Story Problems. *Continuous: Journal of Research in Mathematics Didactics*, *1*(1).

Yusnia, D., & Fitriyani, H. (2017). Identification of Student Errors Using Newman's Error Analysis (NEA) in Solving Arithmetic Operation Problems in Algebraic Forms. *National Seminar on Education, Science and Technology, Faculty of Mathematics and Natural Sciences, Muhammadiyah University of Semarang*, 78–83.

Zulyanty, M. (2019). Newman Error Analysis of Madrasah Students in Solving Mathematical Story Problems. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *3*(2), 379–388.