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Student errors in solving system of linear equations in two variables story problems based on Newman error analysis

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Abstract

The purpose of this study was to describe the types of errors and their causes made by eighth-grade students in solving system of linear equations in two variables (SLETV) problems and to propose solutions to overcome them using the NEA (Newman Error Analysis) procedure. The research method used was descriptive research with a qualitative approach. In this study, data collection involved tests and interviews. The test instrument included a written test with two story problems related to SLETV material in the form of essays. At the same time, interviews were conducted with teachers as a preliminary study and with selected students to determine the types of errors made in solving the given questions. The researcher selected three students as research subjects from all students in class VIII A who made various errors in the interview questions, with one student chosen additionally for their good communication skills. The results showed that the stage with the lowest error rate fell within the sufficient and good categories. Conversely, the answer-writing stage exhibited a high error rate, as all students fell into the less capable category.

Keywords: Mathematics, Newman error analysis, Story problems, System of linear equations in two variables

Introduction

Mathematics is one of the core subjects introduced and taught from the elementary level up to higher education. Mathematics is a science that significantly contributes to the development of educational knowledge (Nurhayati, 2022). This aligns with the advancements of the 21st century, which mark the beginning of the third millennium with progress in information technology, communication, free competition, and global capabilities. One of the real challenges we face in the era of globalization is education, particularly mathematics education. Mathematics is often referred to as the "queen of the sciences" because it forms the foundation of other sciences (Sukoriyanto & Afandi, 2023). Mathematics also plays an essential role as a basis in various fields of education. Therefore, it is crucial to introduce and teach mathematics from an early age (Abdurrahman, 2012). The benefits of mathematics included in

the learning process are: mathematics facilitates clear and logical thinking, mathematics can train students to solve everyday life problems, mathematics serves as a means of understanding patterns and generalizing experiences, mathematics can develop students' creativity, and mathematics can enhance awareness of cultural development (NCTM, 2014). Mathematics is a discipline that fosters the development of thinking abilities in students. As a scientific discipline, mathematics enhances critical thinking and reasoning skills and contributes to solving everyday problems (Anggelina et al., 2023; Fitriatien, 2019).

Mathematical thinking also cultivates students' creative problem-solving abilities, enabling them to approach problems from new and diverse perspectives (Boelens et al., 2018; Utami et al., 2020). When students solve problems, they apply appropriate methods to arrive at correct solutions, effectively addressing the given challenges (Norton et al., 2023; N. Nurhayati et al., 2022). This aligns with the goals of mathematics education, which aim to prepare students to use mathematical concepts and thinking patterns to solve problems they will encounter in daily life (Amir, 2015; Saclarides & Theule, 2021).

Mathematical problems are often associated with daily life and are expressed in the form of story problems. Story problems are a type of question that presents everyday life problems in a narrative or story format (Anggelina et al., 2023). These problems are modified to be presented as meaningful and easily understood sentences (Linola et al., 2017). Additionally, story problems are considered non-routine questions because their solutions are not presented through direct calculation (Benyamin et al., 2021). Therefore, story problems require higher-order thinking skills to solve.

Problems in learning mathematics often arise from students' difficulties in understanding and solving story problems. Research conducted by (Fitriatien, 2022) found that many students struggle to correctly solve mathematical story problems due to several factors, such as a lack of careful reading of the questions, misunderstanding the methods for solving the problems, and being unable to conclude the final solution. Furthermore, research by (Ramlah et al., 2017) on errors in solving addition and subtraction fraction problems identified both conceptual and procedural errors. Conceptual errors included: drafting errors, factual errors, factual errors, and principal errors. Procedural errors observed among students included: errors in arithmetic operations, errors in simplifying fractions, incomplete procedures, and arbitrary approaches. The results of research conducted by (Mauliandri & Kartini, 2020) concluded that the mistakes made by students in completing given mathematical questions occur because students have not yet mastered the techniques for solving such problems, which affects their problem-solving processes.

One of the story problems in learning mathematics can be found in System of Linear Equations in Two Variables (SLETV material. SLETV is a core topic in the junior high school mathematics curriculum for Grade VIII, Semester I. SLETV is often used in solving story problems related to everyday life situations. It helps students connect mathematical concepts by training them to apply mathematics to real-life problems (Khoirunnisa & Amidi, 2022). Furthermore, SLETV encourages students to think critically and creatively, allowing them to develop their unique approaches to solving SLETV problems (Ayu et al., 2023).

The results of observations and interviews at Taman Siswa Middle School, Malang, indicated problems in mathematics learning. Observations and interviews conducted in class VIII A revealed that students have not yet mastered solving mathematical problems presented

in story format on the SLETV material. Some students mentioned that story problems require more complex thinking methods because they do not involve straightforward calculations. Additionally, students find it challenging to translate real-world analogies into mathematical symbols on the SLETV material. This issue impacts the learning process, highlighting the need for alternative methods to analyze student errors in solving story problems.

Student error analysis in solving story problems is based on Newman Error Analysis (NEA). Commonly referred to as the Newman method, it is used to identify student errors in solving descriptive mathematical problems (Iriani et al., 2022). This method assesses student errors through the process they undergo while solving story problems. The process comprises five stages of analysis, namely Reading: Evaluating how the student reads the problem; Understanding: Assessing the student's comprehension of the reading material; Transformation: Converting the words in the problem into an appropriate mathematical model; Processing Skills: Applying the skills needed to solve the established mathematical models; and Encoding: Providing the final answer in an acceptable written form (Newman, 1977).

The advantage of Newman analysis is its comprehensive procedure, starting from how students read the given questions to the point where they can encode the answers derived from solving the problem. Therefore, using the Newman procedure for error analysis is highly suitable for evaluating students' cognitive abilities in accurately and effectively solving story problems. Several researchers have previously analyzed Newman errors in mathematics learning. One such study by (Upu et al., 2022) found that student errors in solving SLETV problems often stem from not mastering the prerequisite material. Students also tend to be careless and rush through their work, leading to persistent mistakes throughout the problem-solving process. The study focused on the student's initial mathematical abilities, indicating a need for further research on student errors in solving SLETV problems considering other aspects. Another study by (Syamsuadi et al., 2021) concluded that student errors in solving SLETV problems, based on PISA content related to change and relationships in Grade VIII of junior high school, included understanding questions, transforming questions, and writing final answers. The causes of these errors were attributed to students not mastering prerequisite materials and being unfamiliar with modeling questions given in the form of mathematical models.

Based on the description above, it is important to conduct a more thorough analysis of student errors in solving SLETV story problems using the Newman procedure, as referenced in previous research. The focus and purpose of this study are to analyze student errors in solving mathematical story problems on SLETV material based on NEA (Newman Error Analysis) and to propose solutions to reduce these errors. Therefore, it is necessary to analyze student errors in solving SLETV story problems based on Newman error analysis. This research is also crucial for comparing student errors identified in previous studies and for evaluating methods to address problems in learning mathematics, specifically in solving SLETV story problems.

Methods

Research design

The type of research employed in this study is descriptive research with a qualitative approach. This descriptive study aims to describe, record, analyze, and interpret the results of

student error analysis in solving SLETV problems using the NEA (Newman Error Analysis) procedures. The qualitative approach in this study was utilized to provide a broader understanding of the issues encountered in the field, highlighting that many students still make errors in solving story problems on SLETV material using the NEA method (Sugiyono, 2010).

Time, setting, and subjects of study

This research was conducted at Taman Siswa Middle School, Malang City, during the odd semester of the 2023/2024 academic year. The subjects of this study were 25 students from class VIII A at Taman Siswa Middle School, Malang City. Each student was given a test in the form of a story problem related to SLETV material. From these 25 students, three students were selected to represent different variations of errors in solving SLETV problems, following the NEA (Newman Error Analysis) procedures.

Research instrument

The instruments used in this study include a written test and interviews. The written test comprised a story problem related to SLETV, which was given to each student. The test is designed to measure the level of knowledge, intelligence, skills in solving exercises, and abilities possessed by each individual (Arikunto, 2016). The test was conducted over one lesson hour (40 minutes) following an explanation of the SLETV material. Interviews were prepared to gather information considered as data for making formulations as accurately as possible according to the study's objectives (Rosaliza, 2015). The purpose of the interviews in this research is to understand the reasons behind students' errors in solving story problems on SLETV material.

Data analysis technique

The data analysis technique used in this study is qualitative data analysis. The data collected will be analyzed through data reduction, data presentation, and conclusion drawing and verification (Sugiyono, 2010). Data reduction involves summarizing and selecting fundamental data related to student errors in solving story problems. Data presentation is carried out by presenting the data in tabular form, making it easier for readers to interpret the information. Conclusion drawing and verification involve making preliminary conclusions and seeking evidence to support them. The analysis of story problem test data on SLETV material using the NEA (Newman Error Analysis) procedure is shown in Table 1.

The data obtained in this study comprise students' answer sheets and interview results, which are used to determine student error categories in solving SLETV problems. Students are grouped into three levels: Good, Adequate, and Insufficient. This classification allows for a clear understanding of the types of errors students make in solving SLETV problems, according to the NEA (Newman Error Analysis) procedure.

Table 1. Prosedur NEA (Newman Error Analysis)

Newman Stages	Category	Description	Code
Reading	Good	Capable of understanding meaning, and symbols and can determine the answer to the question correctly.	A1
	Enough	Capable of understanding meaning, and symbol, and can determine the answer even though it is not quite correct.	
	Not enough	Not capable understanding of the meaning of questions.	
Comprehension	Good	Capable of mentioning all questions asked, as well as determining method solutions for questions asked correctly.	A2
	Enough	Capable of identifying what the question asks and determining the appropriate method for solving the problem. However, there are still errors and the answer remains incomplete.	
	Not enough	Uncapable of answering the question.	
Transformation	Good	Capable of making mathematical models, determining the formula, and using the operation count correctly.	A3
	Enough	Capable of creating mathematical models, determining formulas, and understanding which arithmetic operations to use. However, there are still errors and shortcomings to address.	
	Not enough	Not capable of determining the model, formula, and operations to be used.	
Process Skills	Good	Capable of determining and applying the procedural steps to solve the problem correctly.	A4
	Enough	Capable of determining and applying some or all of the procedural steps to solve the problem. However, there are still errors.	
	Not enough	Capable of determining and applying some or all of the procedural steps to solve the problem. However, there are still numerous errors and incorrect answers.	
Encoding Answer	Good	Capable of determining the final results and writing a conclusion in accordance with the question's requirements.	A5
	Enough	Able to determine the final results and write a conclusion according to the question's requirements, but the answer is incomplete.	
	Not enough	Unable to provide the final answer and conclusion required by the question.	

Results

This study presents the results of students' work in solving story problems related to SLETV material. The test consisted of one question with a working time of one lesson hour (40 minutes). Students completed the test after receiving an explanation from the teacher regarding the SLETV material in mathematics learning. The question presented in the error analysis research is as follows:

Two types of food materials, chicken and beef, are sold in the market. The price per kilogram of chicken is Rp 30,000, and the price per kilogram of beef is Rp 60,000. A mother wants to buy a total of 5 kilograms of chicken and beef with a total cost of Rp 210,000. How many kilograms of chicken and beef did the mother buy?

Instructions:

Step One:

It is explained that:

- The price per kilogram of chicken is Rp 30.000.
- The price per kilogram of meat cows is Rp 60.000. ,-

The problem:

Mother wants to buy 5 kilograms of chicken and beef with a total cost of Rp 210.000. ,-.
How many kilograms of chicken and beef did the mother buy?

- x is the number of kilograms of chicken
- y is the number of kilograms of meat cow

The equality:

Mother wants buy total 5kilograms of chicken and beef:$x + y = 5$
The total cost spent was$30,000x + 60,000y = 210,000$

$$x + y = 5 \qquad (1)$$
$$30,000x + 60,000y = 210,000 \qquad (2)$$

Step two:

We will use method substitution to complete system this equation. Let's change it equality (1)to y in the equivalent form:

$$x + y = 5$$
$$y = 5 - x$$

Next, substitute y in the equation (2)with the values y from the equation.(1):

$$30,000x + 60,000y = 210,000$$
$$30,000x + 60,000\,(5 - x) = 210,000$$
$$30,000x + 300,000 - 60,000x = 210,000$$
$$30,000x - 60,000x = 210,000 - 300,000$$
$$\ldots\ldots x = \ldots$$
$$x = \ldots$$

Step three:

Substitution mark variable x which is already known as the easiest equation to get the value of the variable y:

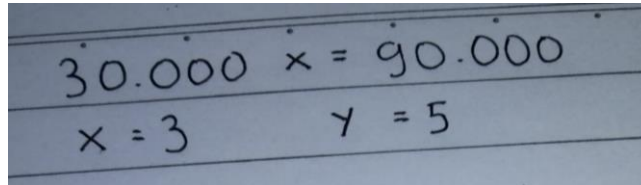$$y = 5 - x$$
$$y = 5 - \ldots$$
$$y = \ldots$$

So, mom buys ... kilograms of chicken and ... kilograms of meat cows to spend Rp. 210.000,-.

In the questions presented above, several alternative solutions were provided, enabling students to correctly solve the given problems. However, some students still made mistakes in solving the questions. The description of student errors can be seen in the types of errors made in solving SLETV questions using NEA (Newman Error Analysis) procedures, as detailed below.

Reading error

In completing questions on the SLETV material, one of the three selected students, who became a subject of this study, made a Reading Error. This error involves misunderstanding the meaning of words, and symbols, and failing to identify keywords in the question. The Reading Error is presented in Figure 1.
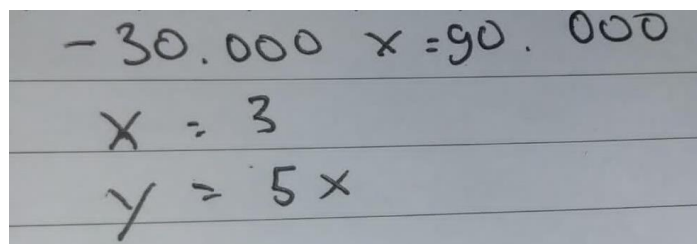

Figure 1. Students' Error in Reading

Figure 1 indicates that student 1 is not yet able to comprehend the question properly. Consequently, in solving the problem, the student makes mistakes in understanding the question's meaning, identifying keywords, and providing a correct final answer. As a result, the student cannot correctly complete the given question. When interviewed, the student explained that the difficulties stem from feeling tired and unenthusiastic about doing the mathematics assignment in the afternoon. The student admitted to merely writing down whatever they knew to quickly finish and submit the assigned questions.

Comprehension error

In solving questions on the SLETV material, one of the three students selected as subjects in this study made an error in understanding the question (Comprehension Error). This error involves incorrectly stating all known and asked information, as well as making mistakes in determining the appropriate method for solving the question. The comprehension error is presented in Figure 2.

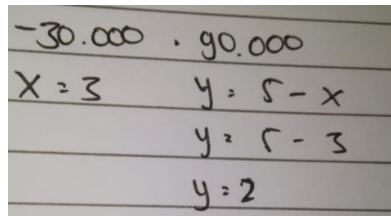**Figure 2.** Students' Comprehension Error

Figure 2 shows that Student 2 was able to understand what the questions meant with the help of the given instructions. However, there were still errors at the comprehension stage. Student 2 could not determine the next steps to solve the story problem mentioned; there were no subtraction or addition symbols used in the following work process, and the student also made an error when trying to determine the value of x.

During the interview, Student 2 explained that they did not fully understand the method to solve the given questions and only followed the existing instructions. Additionally, Student 2 had not yet mastered the multiplication of whole numbers, leading to errors in answering the given questions.

Transformation error

In solving questions on the SLETV material, one of the three students selected as subjects in this study made a transformation error. This type of error involves mistakes in creating mathematical models, determining formulas, and applying arithmetic operations to the questions. The transformation errors are presented in Figure 3.
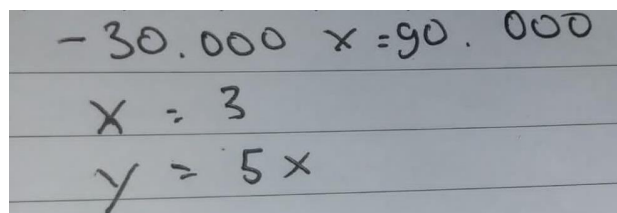

Figure 3. Students' Transformation Error

From Student 3's answer in Figure 3, it is evident that Student 3 was able to read and understand the given story problem, create mathematical models, and determine formulas based on the instructions provided. However, when applying the formulas and performing arithmetic operations within the mathematical model, Student 3 made errors, leading to an incorrect answer. During the interview, Student 3 mentioned that they understood the meaning of the story problem, but rushed through the task to complete it quickly. Consequently, the problem-solving process was not conducted appropriately.

Process skill error

In solving questions on the SLETV material, one of the three students selected as subjects in this study made a process skills error. This error involves mistakes in determining and implementing procedures or steps to solve the problem. Errors at this stage significantly impact the final results. The process skills error is presented in Figure 4 as follows.
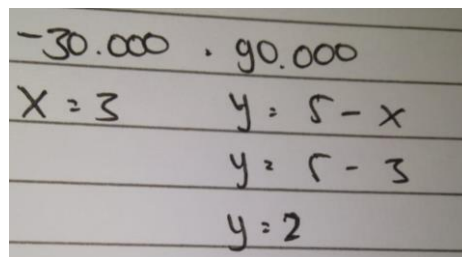

Figure 4. Students' process skill error

Figure 4 shows that Student 2 was unable to complete the steps in the given story problem. While Student 2 could read and understand the given questions using the provided instructions, they struggled with understanding the problem-solving process, leading to an inability to complete the question. During the interview, it was found that many students, including Student 2, faced difficulties with multiplication. Even though Student 2 understood the method and steps to solve the story problem from the given instructions, they encountered challenges when performing arithmetic operations due to an incomplete mastery of multiplication.

Encoding error

In solving questions on the SLETV material, the third student selected as a subject in this study made errors in writing the answers (encoding errors). These errors are the most common mistakes made by students during the problem-solving process for SLETV material. This occurs because students often feel it is unnecessary to rewrite the conclusions they have drawn after finding the answers through arithmetic operations. However, this does not align with the questions in the SLETV material, which are related to real-life applications. Therefore, the obtained solution must be presented in the context of the given question. One example of a student's mistake is shown in Figure 5 as follows.

Figure 5. Students' Encoding Error

Figure 5 illustrates the solution to the questions worked on by Student 3. In the process of solving SLETV material questions, it is evident that Student 3 was able to follow the problem-solving procedure well. However, at the Newman stage, Student 3 lacked in writing the final answer to the question. Specifically, there was no conclusion written by Student 3 regarding the obtained answer, preventing it from being mathematically expressed according to the given question context.

During the interview, Student 3 mentioned that they are not accustomed to writing conclusions for the given questions. Typically, the questions they encountered were not in the form of story problems but rather standard questions. Furthermore, when story problems were given, there was no reinforcement for students to write their answers in a manner that returned to the given question context.

Discussion

In this study, the results of the written tests completed by students were analyzed using qualitative data analysis based on the Newman procedure. This was done to obtain a description of students' abilities in solving SLETV questions at each stage of the Newman procedure. Student abilities were categorized into three levels: Good, Adequate, and Insufficient. The analysis results of the categories of mistakes made by students in completing SLETV questions using the Newman procedure are shown in Table 2.

Table 2 shows that the transformation stage has the lowest error level. This indicates that students in this stage, categorized as sufficient and good, are capable of creating mathematical models, determining formulas, and knowing which arithmetic operations to use. However, there are still errors and shortcomings in completing the SLETV material. Conversely, the stage of writing answers exhibits the highest error level. This is evidenced by the fact that all students

fall into the insufficient category, indicating that they are unable to provide the final answer and conclusion as required by the question.

Students who are less proficient in solving story problems fall into the "less" category. Based on Table 2, the most common error is in writing answers (encoding). In the given questions, it is evident that all students who were subjects in this study made the same mistake, an error at the stage of writing the answer (encoding). The results of this study align with the research conducted by (Sunardiningsih et al., 2019) who stated that students' errors in working on the given mathematics problems were at the final stage, namely when students wrote the final answer (encoding). This underscores the importance of emphasizing the concept of the material being studied during the student learning process. When students solve the given problems, a correct understanding of the concept ensures that their answers will be accurate through to the final stage, including writing and concluding the answer.

Table 2. Ability Results in Solving Problems on SLETV Material Using the Newman Procedure Based on Category

Newman Stages	Category	Amount Subject
Reading	Good	2
	Enough	0
	Not enough	1
Comprehension	Good	2
	Enough	0
	Not enough	1
Transformation	Good	2
	Enough	1
	Not enough	0
Process Skills	Good	0
	Enough	2
	Not enough	1
Encoding	Good	0
	Enough	0
	Not enough	3

The errors made by students can be attributed to several factors. These include students not reading the main information in the question, leading to their failure to use the information correctly and resulting in answers that do not align with the question's intent. Additionally, students may not understand the concept, are unsure of what the question is asking, or misinterpret the information provided, preventing them from solving the problem correctly. Furthermore, students may struggle to accurately transform the question into a mathematical form and use arithmetic operation signs correctly. Finally, students may not yet be skilled in calculations, leading to errors in the solution process (Newmann & Wehlage, 1993).

Conclusion

The most common mistake made by students when solving SLETV problems occurs at the stage of writing the final answer (encoding). Previous research indicated that students struggled with understanding questions, transforming questions into mathematical models, and writing the final answer. This study shows that errors in solving story problems have decreased. Several factors contribute to this improvement, including students rushing through questions, students

not being accustomed to the stage of writing the final answer, and students believing that solving up to the mathematical calculation process is sufficient.

Therefore, it is crucial for educators and teachers to focus on students' multiplication abilities, which are of significant importance at the junior high school level. When solving story problems, students reported that one of the major difficulties was their insufficient and below-average multiplication skills. Consequently, students tend to work more slowly and require more time to solve questions involving multiplication. This issue renders the learning process ineffective and inefficient.

Declarations

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References

Abdurrahman, M. (2012). *Anak berkesulitan belajar teori, diagnosis, dan remediasinya.* Rineka Cipta.

Amir, Z. (2015). Mengungkap seni bermatematika dalam pembelajaran. *Suska Journal of Mathematics Education*, *1*(1), 60. https://doi.org/10.24014/sjme.v1i1.1364

Anggelina, M., Rosyidah, U., & Setyawati, A. (2023). Analisis kemampuan siswa menyelesaikan soal matematika berbentuk cerita pada siswa kelas x smk negeri 1 pekalongan. *Jurnal Ilmiah Matematika Realistik*, *4*(1), 89–95.

Arikunto, S. (2016). *Prosedur penelitian*. Rineka Cipta.

Ayu, M.S., Susiswo, S., & Sa'dijah, C. (2023). Proses berpikir kritis siswa dalam memecahkan masalah matematika. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(3), 3075. https://doi.org/10.24127/ajpm.v12i3.7508

Benyamin, B., Qohar, A., & Sulandra, I.M. (2021). Analisis kemampuan berpikir kritis siswa sma kelas x dalam memecahkan masalah spltv. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(2), 909–922. https://doi.org/10.31004/cendekia.v5i2.574

Boelens, R., Voet, M., & Wever, B. De. (2018). The design of blended learning in response to student diversity in higher education: instructors' views and use of differentiated instruction in blended learning. *Biomass Chem Eng*, *3*(2), ٱقٱقٱقٱق. http://doi.org/10.1016/j.compedu.2018.02.009 To

Fitriatien, S.R. (2019). Analisis kesalahan siswa dalam menyelesaikan soal cerita matematika berdasarkan prosedur newman. *Lentera Sriwijaya : Jurnal Ilmiah Pendidikan Matematika*, *1*(2), 1–12. https://doi.org/10.36706/jls.v1i2.9707

Fitriatien, S.R. (2022). Analisis kesalahan dalam menyelesaikan soal teorema bayes. *JIPMat: Jurnal Ilmiah Pendidikan Matematika*, *4*(1), 59–67. https://doi.org/10.26877/jipmat.v4i1.3550

Iriani, A., Sridana, N., Triutami, T.W., & Azmi, S. (2022). Analisis kesalahan dalam menyelesaikan soal integral taktentu dengan metode newman ditinjau dari kemampuan matematis. *Griya Journal of Mathematics Education and Application*, *2*(4), 1072–1084. https://doi.org/10.29303/griya.v2i4.257

Khoirunnisa, K., & Amidi. (2022). Kajian teori : pengembangan bahan ajar berbasis outdoor learning dengan model connected mathematics project (cmp) dan pendekatan saintifik untuk meningkatkan kemampuan koneksi matematis. *Prisma Prosiding Seminar Nasional Matematika*, *5*, 559–564.

Linola, D.M., Marsitin, R., & Wulandari, T.C. (2017). Analisis kemampuan penalaran matematis peserta didik dalam menyelesaikan soal cerita di sman 6 malang. *Pi: Mathematics Education Journal*, *1*(1), 27–33. https://doi.org/10.15797/concom.2019..23.009

Mauliandri, R., & Kartini, K. (2020). Analisis kesalahan siswa menurut kastolan dalam menyelesaikan soal operasi bentuk aljabar pada siswa smp. *AXIOM : Jurnal Pendidikan Dan Matematika*, *9*(2), 107–123. https://doi.org/10.30821/axiom.v9i2.7687

NCTM. (2014). *Principles to actions: ensuring mathematical success for all*. The National Council of Teachers of Mathematics.

Newman, F.M. (1977). An analysis of sixth-grade pupil's error on written mathematical tasks. *Victorian Institute for Educational Research Bulletin*, *39*(1), 31–43.

Newmann, F.M., & Wehlage, G.G. (1993). Five Standards of Authentic Instruction. *Educational Leadership*, *50*(7), 8–12.

Norton, A., Ulrich, C., & Kerrigan, A. (2023). Unit transformation graphs: modeling students' mathematics in meeting the cognitive demands of fractions multiplication tasks. *National Council of Teachers of Mathematics (NCTM)*, *54*(4), 240–259. https://doi.org/10.5951/jresematheduc-2021-0031

Nurhayati, A.S. (2022). Analisis kesalahan siswa smp dalam menyelesaikan soal pada materi aritmatika sosial. *Apotema: Jurnal Program Studi Pendidikan Matematika*, *6*(1), 54–66. http://publikasi.stkippgri-bkl.ac.id/index.php/APM/article/view/153

Nurhayati, N., Subanji, S., & Rahardjo, S. (2022). Proses pemecahan masalah sistem persamaan linear dua variabel berdasarkan tahapan mason ditinjau dari tipe adversity quotient. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *6*(1), 615–634. https://doi.org/10.31004/cendekia.v6i1.1239

Ramlah, R., Bennu, S., & Paloloang, B. (2017). Analisis kesalahan siswa dalam menyelesaikan soal penjumlahan dan pengurangan pecahan di kelas vii smpn model terpadu madani. *JIPMat: Jurnal Ilmiah Pendidikan Matematika*, *1*(2), 182–194. https://doi.org/10.26877/jipmat.v1i2.1245

Rosaliza, M. (2015). Wawancara: sebuah interaksi komunikasi dalam penelitian kualitatif. *Jurnal Ilmu Budaya*, *11 (2), 71-79.* https://doi.org/10.31849/jib.v11i2.1099

Saclarides, E.S.L., & Theule, S. (2021). Teachers' mathematics learning opportunities during one-on-one coaching conversations. *National Council of Teachers of Mathematics (NCTM)*, *52*(3), 250–256. https://doi.org/10.5951/jresematheduc-2020-0092

Sugiyono. (2010). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta.

Sukoriyanto, & Afandi, A.F. (2023). The creative thinking process of 8th grade junior high school students in solving sequence of number problems based on wallas theory. AIP Conference Proceedings, 2569(1). https://doi.org/ 10.1063/5.0112370

Sunardiningsih, G. W., Hariyani, S., & Fayeldi, T. (2019). Analisis kesalahan siswa dalam menyelesaikan soal matematika berdasarkan analisis newman. *RAINSTEK : Jurnal Terapan Sains & Teknologi*, *1*(2), 41–45. https://doi.org/10.21067/jtst.v1i2.3447

Syamsuadi, A., Darmadi, M. F., & Dassa, A. (2021). Analisis kesalahan siswa dalam menyelesaikan soal SLETV berorientasi pisa dengan konten change and relationship pada kelas viii smp unismuh makassar. *Sigma: Jurnal Pendidikan Matematika*, *13*(2), 103–118. https://doi.org/10.26618/sigma.v13i2.6316

Upu, H., Dassa, A., & R., N. (2022). Analisis kesalahan siswa dalam menyelesaikan soal materi sistem persamaan linear dua variabel ditinjau dari kemampuan awal matematika. *Issues in Mathematics Education (IMED)*, *6*(1), 83–98. https://doi.org/10.35580/imed32233

Utami, R.W., Endaryono, B.T., & Djuhartono, T. (2020). Meningkatkan kemampuan berpikir kreatif. *Faktor Jurnal Ilmih Kependidikan*, *7*(1), 43–48.