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Analysis Of Student Mistakes In Solving Mathematics Problems On The Topic Of Operations In Algebraic Forms For Class VIII SMP Negeri 4 Kawangkoan

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Abstract. *When learning mathematics, students sometimes experience errors in understanding concepts, data, procedures, and principles, especially in algebraic operations. This research analyzes students' errors in solving mathematics problems on algebraic operations material. The research method used is a descriptive method with a qualitative approach. The research subjects were class VIII students at SMP Negeri 4 Kawangkoan. The instruments used were written tests, interviews, and expert validation. Data analysis techniques use qualitative techniques, including data collection, reduction, and conclusion. The conclusions obtained include that students experience three types of errors in solving mathematics problems: data errors, theorem or definition errors, and technical errors.*

Keywords: *Analysis, Student Errors, Mathematics Problems, Algebraic Operations.*

INTRODUCTION

Mathematics is a general science that underlies the development of modern technology, has a vital role in various scientific disciplines, and is a learning tool for advancing human thinking power. Mathematics lessons need to be given to all students, from primary to secondary education, to equip students with the ability to think logically, analytically, regularly, critically and creatively, as well as the ability to work together (Mangelep, 2013; Kamarullah, 2017 ; Judijanto et al., 2024). These competencies will benefit students entering real life and pursuing a career in any field (Muspiroh, 2016; Mangelep, 2017).

Based on the results of interviews with several students at SMP N 4 Kawangkoan, they stated that they did not like mathematics lessons. According to them, mathematics is a complicated subject that is difficult to understand. Even though mathematics is a field of study that students must master because it solves everyday problems, it is also studied at every level of education. It is an indicator (measure) of student success in pursuing a certain level of education and being test material in admissions selection—workforce in specific fields.

From the researcher's experience teaching algebraic operations at SMP N 4 Kawangkoan in class VIII, the researcher found many students' mistakes in solving questions on Algebraic Operations material. After it was discovered, it turned out that the students needed to become more skilled in integer counting operations. This is because when the teacher explains, only some students can understand it well, and students need

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more practice working on the questions. Apart from that, students still need to understand the definitions of variables, coefficients, and constants, which results in errors when teaching questions related to variables, coefficients, and constants. For example, students add two constants with different variables in the additional operation. As a result, students needed help solving questions on Algebraic Operations material. Therefore, researchers are interested in analyzing students' errors in solving questions on Algebraic Operation material, especially in class VIII at SMP N 4 Kawangkoan.

Giving tests can identify the location of student errors. It is essential to analyze student errors to discover where students made mistakes when solving questions (Cahyani & Sutriyono, 2018; Ayuningsih et al., 2020; Mangelep et al., 2023). That way, teachers can take appropriate actions to reduce errors among students (Selvianiresa, 2017; Anwar & Hidayani, 2020; Mangelep et al., 2023).

The researcher chose Algebraic Operations material because this material is a prerequisite material for moving on to the following material. Because this material is so important, students must master this material to study the following material, such as Straight Line Equations and Systems of Linear Equations in Two Variables (Putri et al., 2014; Mangelep et al., 2024).

Researchers analyzed students' errors in solving Algebraic Operation problems based on this background. For this reason, this research was carried out with the title "Analysis of Students' Errors in Solving Mathematics Problems on Algebra Operation Material for Class VIII SMP Negeri 4 Kawangkoan". Analyze the mistakes made by students by looking for errors and the factors that cause them. So, errors in solving mathematics problems in Algebraic Form Operations material can be minimized to improve mathematics learning achievement.

METHOD

This research aims to provide an overview of the errors and their causes made by class VIII students of SMP Negeri 4 Kawangkoan in solving mathematics problems related to algebraic operations. The type of research used in this research is descriptive qualitative research. Qualitative research intends to understand the phenomena experienced by research subjects using descriptions in words and language in a unique natural context and using various scientific methods.

This research is qualitative and uses descriptive methods. The descriptive method examines the status of a group of people, an object, a set of conditions, a system of thought, or a class of events in the present. The aim of this descriptive research is to create systematic, factual, and accurate descriptions of images or paintings regarding the facts, properties, and relationships between the phenomena being investigated.

Data was collected in the odd semester of the 2022/2023 academic year in November 2022. The research was conducted in class VIII of SMP N 4 Kawangkoan, located in Kanonang Tiga Village, West Kawangkoan sub-district, Minahasa Regency. The reason for taking the location at SMP N 4 Kawangkoan was because the researcher had carried out Field Experience Practices (PPL) at SMP N 4 Kawangkoan, so an initial picture of the character of class VIII students at SMP N 4 Kawangkoan was already known, and aroused the researcher's curiosity to analyze the types of students in class VIII—types of errors in solving mathematics problems in Algebraic Form Operations material. The subjects in this research were 20 class VIII students at SMP N 4 Kawangkoan in the odd semester of the 2022/2023 academic year. Meanwhile, the object of this research is the mistakes of class VIII students at SMP N 4 Kawangkoan in working on questions on Algebraic Operations material and the factors that cause these errors.

Researchers use data collection methods to obtain the necessary data. In this research, researchers used two data collection methods: written tests and interviews. The instruments used are written test questions, interview guidelines, and expert validation. Regarding data analysis methods, they used correction analysis, analysis of grouping types and types of errors, and analysis of interview transcripts.

RESULT AND DISCUSSION

The research was carried out at SMP N 4 Kawangkoan class VIII in November 2022 on the topic of Algebraic Form Operations for the 2022/2023 academic year. The total number of class VIII students is 20.

This research went through several stages, from the preparation to the data collection stage. Data collection was carried out from 14 November 2022 to 23 November 2022. Before the researcher gave the diagnostic test, the teacher entered the class first to remind them about Algebraic Form Operations for 30 minutes. The teacher gave practice questions and then discussed the questions. The diagnostic test is carried out for 60 minutes.

Analyze student work data

The following are the types of errors found in class VIII at SMP N 4 Kawangkoan when working on questions on Algebraic Operations.

Table 1. Types and Types of Student Errors

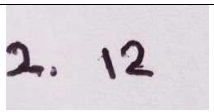
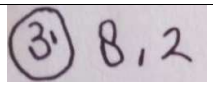
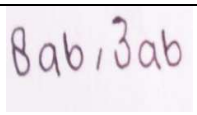
Questions	Types of Errors	Error Type	Presence
1	Theorem or definition error	Applying the theorem to inappropriate conditions	10,15,17,19,20
2	Data error	Ignoring important data provided	05, 12, 13
		Interpreting information does not match the actual text	04, 10, 16, 17, 19, 20
3	Data error	Ignoring important data provided	02, 04, 08, 09, 12, 13
		Interpreting information does not match the actual text	03, 05, 07, 11, 15, 16, 18, 19
4	Data error	Ignoring important data provided	07, 09, 11, 12, 13, 20
		Interpreting information does not match the actual text	03, 04, 17, 18, 19
5	Data error	Interpreting information does not match the actual text	07, 18
		Copying data	05, 11, 16, 20
	Technical problem	Calculation	02, 05, 08, 09, 12, 13, 19, 20
6	Data error	Ignoring important data provided	13
		Copying data	02, 05, 20
	Technical problem	Calculation	05, 08, 09, 12, 13, 19, 20
7	Technical problem	Calculation	02, 08, 12, 13, 17
8	Technical problem	Calculation	08,17
9	Technical problem	Calculation	08

The following is a description of the types of student errors found by researchers in working on the given Algebraic Operations questions:

1. Data Error

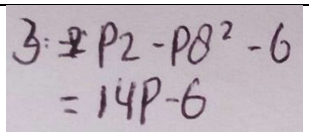
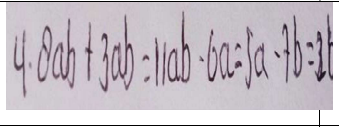
In the diagnostic test results, several types of errors were found by students. The following are the types of student errors from the types of data errors:

Table 2. Types of Errors Ignoring Important Data Provided

Question	Example Answer	Student Number	Information
2.		05, 12, 13	Students make a mistake by not including the operation sign in front of the constant
3.		04, 08, 12, 13	Students make a mistake by not including the operation sign in front of the coefficient
4.		09, 07, 11, 20	Students make a mistake by not including the operation sign in front of the term

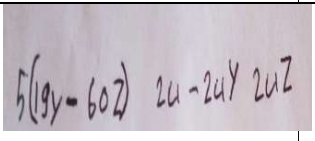
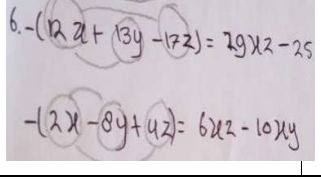
In the diagnostic test results, it was found that 9 students made data errors with the type of error ignoring important data provided so that this would later cause errors in the next step when students calculated from solving the algebraic form.

Table 3. Types of errors interpreting information that does not match the actual text.

Question	Example Answer	Student Number	Information
3.		03, 05, 07, 10, 11, 15, 16, 18, 19	Data errors with this type of error mean that information does not match the actual text. Students make mistakes in interpreting instructions to solve problems.
4.		03, 04, 17, 18, 19, 20	

In this diagnostic test, it was found that 12 students made data errors with the type of error interpreting information that did not match the actual text. Students misinterpret commands to solve problems.

Table 4. Types of Data Copying Errors.

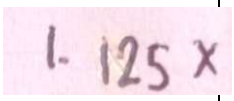
Question	Example Answer	Student Number	Information
5.		05,11, 16.20	Data error with data copy error type. Students make mistakes in copying the questions that have been given.
6.		02,05, 20	

In this diagnostic test, it was found that 5 students made data errors with the type of data copying error. Students make mistakes when copying the questions that have been given.

2. Theorem or Definition Error

On diagnostic tests, students commit theorem or definition errors. Several types of theorem or definition errors were found by students, namely:

Table 5. Types of Errors Applying the Theorem to Inappropriate Conditions.

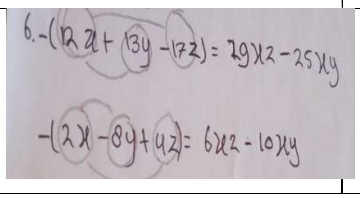
Question	Example Answer	Student Number	Information
1		10, 15, 17, 19, 20	Theorem or definition error. Students misunderstand the definition so that students make mistakes in determining variables from the given algebraic form.

In the error type of applying the theorem to inappropriate conditions, it was found that 5 students made errors in determining variables from the given algebraic form.

3. Technical Error

On the diagnostic test, the student made a Technical error. Several types of technical work were found by students, namely:

Table 6. Types of Calculation Errors.

Question	Example Answer	Student Number	Information
6		02, 05, 08, 09, 12, 13, 19, 20	Students' calculation errors are incorrect in adding and subtracting algebraic forms.

In this research, it was found that students were not able to understand addition and subtraction in algebraic forms so that students made mistakes when working on problems.

Data Analysis

To find out the factors that influence students to make the mistakes above, researchers have interviewed all class VIII students at SMP N 4 Kawangkoan. The results of the interviews were similar in terms of the causes of the errors. The following is an analysis of interviews with students number 05 and 12:

1. Analysis of Student Interview Number 05

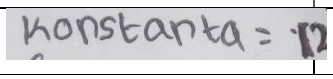
From the results of the diagnostic test analysis, it can be seen that student number 05 made 3 types of errors, namely data errors, theorem or definition errors and technical

errors. Data errors students make can be seen from needing to be more precise in determining constants. Theorem or definition of errors students make can be seen in students making mistakes in determining coefficients. Technical errors can be seen when students make algebraic addition operations.

a. Data error

The type of data error made by student number 05 was found in the diagnostic test:

Table 7. Examples of types of data errors made by Student number 05.

Question	Student Answer	Error Type
2		Ignoring important data provided

Then the researcher conducted an interview with student number 05 to find out why the student made this mistake. The following is a transcript of the interview with student number 05:

Q : Is this correct? (points to answer)

S : yes sis.

Q : If you have a problem like this: 12y-2, if you are asked to determine the constant, what is the answer?

S : 2 sis.

P : Try to pay close attention.

S : oh -2 sis? (with hesitation)

P : now pay attention to your answer (while pointing to the answer)

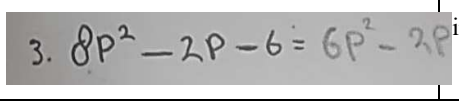
S : yes sis, I was wrong. I often forget that mines

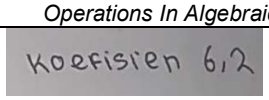
Based on the interview above, students are able to determine constants but still often forget to include the operation sign in front of the constant.

b. Theorem or Definition Error

Types of Theorem or Definition errors made by student number 05 found in the diagnostic test:

Table 8. Examples of types of theorem/definition errors made by student number 05

Question	Student Answer	Error Type
3		Not being thorough or precise in quoting definitions

The following is a transcript of the interview with student number 05 regarding the mistakes he made in question number 03:

S : I think this should be deducted, bro? (points 8p^2-2p)

Q : why is it like that?

S : because what I remember is that we have to simplify the problem.

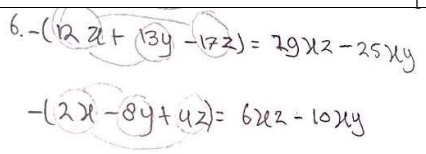
P : Well, next time, pay more attention to the order of the questions, so that the definition or theorem used is not wrong, also what the deck meant earlier cannot be done because it is not a similar term.

Based on the interview above, student number 05 does not understand what is meant by the question and the student is also unable to remember and understand the correct definition or theorem that can be applied.

c. Technical problem

It was found that a type of technical error was made by student number 05 in the diagnostic test, for example in question number 06:

Table 9 Examples of Types of Technical Errors made by Student number 05.

Question	Student Answer	Error Type
6		Calculation Error

Then the researcher conducted an interview with student number 05 to find out why the student made this mistake. The following is a transcript of the interview with student number 05 regarding the student's error in question number 06:

Q : Why did you solve question number 06 like this?

S : I don't know either, sis

P : only like terms can be added or subtracted

S : Well, that means I'm wrong, Sis. I don't understand this material yet

Based on the interview above, student number 05 does not really understand the requirements for addition or subtraction in algebraic forms. Thus, students still make mistakes in calculations.

The following is a transcript of a student's interview when asked about the reasons why students make mistakes:

S: I also don't really understand this material because when Mner explained this material my friends who were sitting in front of me couldn't keep quiet so I couldn't hear clearly when Mner explained. And also for this material we were told to study independently so I couldn't understand this material.

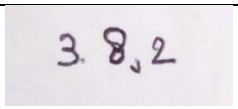
Based on the interview transcript, it can be seen that the reason why student number 05 made a mistake was because of the lack of explanation from the teacher and the noisy class conditions which caused the student to not receive the lesson well.

2. Analysis of Student Interview Number 12

From the results of the diagnostic test analysis, it can be seen that student number 12 made 2 types of errors, namely data errors and technical errors. Data errors made by students can be seen from students not being precise in determining coefficients. Technical errors made by students can be seen from the calculation errors made by students so that students write the answers incorrectly.

a. Data error

Table 10. Examples of types of technical errors made by student number 12.

Question	Student Answer	Error Type
3		Ignoring important data provided

Then the researcher conducted an interview with student number 12 to find out why the student made a mistake. The following is a transcript of an interview with students regarding the answer to question number 03:

Q : Is your answer correct? (while pointing to the answer)

S : yes bro. (so sure)

P : try to pay close attention. Is your answer not wrong?

S : I don't think so, bro.

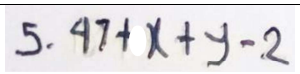
P : try to pay attention to the signs of surgery! (while pointing to the question)

S : Oh yeah, I forgot the minus sign

From the interview transcript above, it can be seen that student number 12 is able to determine the coefficient but students often forget to pay attention and include the existing operational signs. So students still make mistakes.

b. Technical problem

Table 11. Examples of types of technical errors made by student number 12.

Question	Student Answer	Error Type
5		Calculation Error

Then the author conducted interviews with students. The following is a transcript of the researcher's interview with student number 12:

Q : how did you find this answer? (pointing to the results of the work)

S : I forgot, bro. I'm just adding up.

Q : If I told you to finish it again, how would you finish it?

S : I don't know because Mner didn't explain that. We were only told to take notes.

P : okay then let me teach you (carefully explaining)

From the interview transcript above, it is known that students do not understand and understand how to solve the questions in question, so students answer randomly.

The following is a transcript of the student's interview when asked why the student made a mistake:

S : I don't understand and understand this material, because when this material is available it rarely comes in and once it comes in it's only for a moment and then it goes away, we are only given the task of taking notes and doing questions.

Based on the results of interviews with student number 12, it can be seen that students make mistakes due to the teacher's lack of role in the teaching and learning process. This resulted in some students not understanding and understanding how to solve the questions given.

Discussion

From the analysis results obtained, namely analysis of student work results and analysis of interview results, the researcher concluded that all the mistakes made by class VIII students of SMP N 4 Kawangkoan in solving Algebraic Form Operations questions could be grouped according to existing categories. This categorization is based on interviews with research subjects (Astuti & Sari, 2018). Researchers have been allowed to interview all SMP N 4 Kawangkoan class VIII students. The results of the interviews obtained from the causes of errors made by students were similar. Based on the analysis results, the errors found in class VIII of SMP N 4 Kawangkoan in solving Algebraic Operation questions were theorem or definition, data, and technical errors. Based on the results of the interviews, students were less careful and needed to practice more questions,

which caused students to make mistakes. The role of the teacher in teaching the material and the classroom atmosphere when providing the material that is not conducive causes students to have difficulty understanding, and this can also cause students to make mistakes in solving questions on Algebraic Form Operations.

From the results of the data analysis above, it can be concluded that there are factors that cause class VIII students at SMP N 4 Kawangkoan to make mistakes in solving Algebraic Operations questions, namely: (1) Students are not careful in carrying out arithmetic operations , (2) Students do not understand the meaning of the questions given, (3) Students do not pay close attention to the questions so that students make mistakes when working on questions, (4) Students lack practice in solving questions on Algebraic Form Operations , (5) Students are too hasty in solving questions, (6) Students have not mastered the prerequisite material, (7) Students have not received a thorough explanation of the material from the teacher, (8) Students have not understood the Algebraic Shape Operations material well, (9) The classroom atmosphere is less conducive causing students to have difficulty understanding the Shape Operations material. Algebra.

The results above align with Dewi and Kursini's (2014) and Astuti and Sari's (2018) research results. These research results have analyzed learning difficulties in algebraic structure and algebraic form factorization material, contributing to the analysis of students' difficulties in algebraic operations material.

Research Weaknesses

During the research, the researcher experienced several difficulties so that this research was deemed not optimal. Weaknesses in this research include: (1) The diagnostic test was carried out during the last lesson period so that students could not focus on the questions given, and (2) Interviews were not carried out after the diagnostic test. This is due to time constraints, resulting in students forgetting the answer and having to remember it again. So researchers have difficulty digging deeper into the causes of students making mistakes in solving questions.

CONCLUSION

The types of errors made by class VIII students of SMP N 4 Kawangkoan in solving mathematics problems on the topic of Algebraic Form Operations are grouped into 3 types of errors and several types of errors in each type of error. The following are the types of errors and types of errors found by researchers: (1) Data Errors, (2) Theorem

or Definition Errors, and (3) Technical Errors. In the results of the analysis of student answers and analysis of student interviews, factors were found that caused students to make mistakes, namely: (1) Students were not careful in carrying out arithmetic operations, (2) Students did not understand the meaning of the questions given, (3) Students did not pay close attention to questions well so that students make mistakes when working on questions, (4) Students lack practice in solving questions on Algebraic Form Operations, (5) Students are too hasty in solving questions, (6) Students have not mastered the prerequisite material, (7) Students do not receive a thorough explanation of the material from the teacher, (8) Students do not understand the Algebraic Form Operations material well, (9) The classroom atmosphere is lacking conducive causing students to have difficulty understanding the Algebraic Form Operations material.

REFERENCES

Anwar, Z., & Hidayani, H. (2020). Analisis kesalahan Siswa SMP kelas VIII dalam menyelesaikan Soal Lingkaran. *Jurnal Mercumatika: Jurnal Penelitian Matematika Dan Pendidikan Matematika, 4*(2), 71-79.

Astuti, & Sari, N. (2018). Analisis kesulitan belajar struktur aljabar di STKIP Pahlawan Tuanku Tambusai. *Jurnal Pendidikan Matematika, 12*(2), 73-80.

Ayuningsih, R., Setyowati, R. D., & Utami, R. E. (2020). Analisis kesalahan siswa dalam menyelesaikan masalah program linear berdasarkan teori kesalahan kastolan. *Imajiner: Jurnal Matematika Dan Pendidikan Matematika, 2*(6), 510-518.

Cahyani, C. A., & Sutriyono, S. (2018). Analisis Kesalahan Siswa Dalam Menyelesaikan Soal Pada Materi Operasi Penjumlahan dan Pengurangan Bentuk Aljabar Bagi Siswa Kelas VII SMP Kristen 2 Salatiga. *JTAM (Jurnal Teori dan Aplikasi Matematika), 2*(1), 26-30.

Dewi, K. I. S., & Kusrini. (2014). Analisis Kesalahan Siswa Kelas VIII dalam Menyelesaikan Soal pada Materi Faktorisasi Bentuk Aljabar SMP Negeri 1 Kamal Semester Gasal Tahun Ajaran 2013/2014. *Jurnal Ilmia Pendidikan Matematika, 3*(2), 8724-11690-1-PB.

Judijanto, L., Manu, C. M. A., Sitopu, J. W., Mangelep, N. O., & Hardiansyah, A. (2024). THE IMPACT OF MATHEMATICS IN SCIENCE AND TECHNOLOGY

DEVELOPMENT. *International Journal of Teaching and Learning, 2*(2), 451-458.

Kamarullah, K. (2017). Pendidikan matematika di sekolah kita. *Al Khawarizmi: Jurnal Pendidikan Dan Pembelajaran Matematika, 1*(1), 21-32.

Mangelep, N. (2013). Pengembangan Soal Matematika Pada Kompetensi Proses Koneksi dan Refleksi PISA. *Jurnal Edukasi Matematika, 4*(7), 451-466.

Mangelep, N. O. (2015). Pengembangan Soal Pemecahan Masalah Dengan Strategi Finding a Pattern. Konferensi Nasional Pendidikan Matematika-VI, (KNPM6, Prosiding), 104-112.

Mangelep, N. O. (2017). Pengembangan perangkat pembelajaran matematika pada pokok bahasan lingkaran menggunakan pendekatan PMRI dan aplikasi geogebra. *Mosharafa, 6*(2), 193-200.

Mangelep, N. O. (2017). Pengembangan Website Pembelajaran Matematika Realistik Untuk Siswa Sekolah Menengah Pertama. *Mosharafa: Jurnal Pendidikan Matematika, 6*(3), 431-440.

Mangelep, N. O., Mahniar, A., Nurwijayanti, K., Yullah, A. S., & Lahunduitan, L. O. (2024). PENDEKATAN ANALISIS TERHADAP KESULITAN SISWA DALAM MENGHADAPI SOAL MATEMATIKA DENGAN PEMAHAMAN KONEKSI MATERI TRIGONOMET.

Mangelep, N. O., Tarusu, D. T., Ester, K., & Ngadiorejo, H. (2023). Local Instructional Theory: Social Arithmetic Learning Using The Context Of The Monopoly Game. *Journal of Education Research, 4*(4), 1666-1677.

Mangelep, N. O., Tarusu, D. T., Ngadiorejo, H., Jafar, G. F., & Mandolang, E. (2023). OPTIMIZATION OF VISUAL-SPATIAL ABILITIES FOR PRIMARY SCHOOL TEACHERS THROUGH INDONESIAN REALISTIC MATHEMATICS EDUCATION WORKSHOP. *Community Development Journal: Jurnal Pengabdian Masyarakat, 4*(4), 7289-7297.

Mangelep, N. O., Tiwow, D. N., Sulistyaningsih, M., Manurung, O., & Pinontoan, K. F. (2023). The Relationship Between Concept Understanding Ability And Problem-Solving Ability With Learning Outcomes In Algebraic Form. *Innovative: Journal Of Social Science Research, 3*(4), 4322-4333.

Mangelep, N., Sulistyaningsih, M., & Sambuaga, T. (2020). Perancangan Pembelajaran Trigonometri Menggunakan Pendekatan Pendidikan Matematika Realistik Indonesia. *JSME (Jurnal Sains, Matematika & Edukasi), 8*(2), 127-132.

Putri, A. P., Nursalam, N., & Sulasteri, S. (2014). Pengaruh penguasaan materi prasyarat terhadap hasil belajar matematika siswa kelas VIII SMPN 1 Sinjai Timur. *MaPan: Jurnal Matematika Dan Pembelajaran, 2*(1), 17-30.

Selvianiresa, D. (2017). Kesulitan siswa sekolah dasar pada materi nilai tempat mata pelajaran matematika di kelas i sd. *Pendas: Jurnal Ilmiah Pendidikan Dasar, 2*(1), 65-73.

Untari, E. (2013). Diagnosis Kesulitan Belajar Pokok Bahasan Pecahan pada Siswa Kelas V Sekolah Dasar. *Jurnal Ilmiah STKIP PGRI Ngawi, 13*(01).