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Analysis of Students' Errors in Solving Problems Involving Algebraic Expressions

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Abstract

This study aims to describe students' errors in solving algebra problems in class VII A of SMP Negeri 3 Dampelas. This research employs a descriptive method with a qualitative approach. Three students from class VII A were selected as research subjects, focusing on conceptual and procedural errors. The identified errors include mistakes in concepts, principles, and facts. Conceptual errors involve misconceptions in the addition of like terms. Principle errors occur when students incorrectly conclude the final answer. Factual errors involve mistakes in writing variables. Procedural errors include general mistakes, arithmetic operation errors, and errors in simplifying algebraic fractions.

Keywords: *error analysis; conceptual error; procedural error; algebraic expressions*

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INTRODUCTION

Mathematics is studied at every level of education, from elementary school to college. According to Dewi (2014), some mathematical concepts are easier to understand and result in fewer errors, while more difficult concepts tend to lead to a higher number of mistakes. In reality, many students still struggle with the basic concepts of algebraic expressions, which causes errors when solving algebraic problems (Saputro et al., 2018). Furthermore, O'Brien & Riordain (2016) state that students' difficulties in understanding algebra stem from their struggles with fundamental concepts and their connection to other mathematical topics, which serve as prerequisites for learning algebra. Similarly, Nurrahman (2015) emphasizes that algebra is a crucial branch of mathematics often perceived as difficult, leading students to make frequent errors in algebraic expressions. Therefore, it is essential for students to develop a solid understanding of algebraic concepts to minimize errors when solving algebraic problems.

When students are given assignments or exercises on specific mathematical topics, teachers can assess their mastery of the material. Additionally, teachers can evaluate students' understanding by analyzing their mistakes. If errors occur in students' work, it is important to investigate them further by identifying the source of the mistake. The information obtained from analyzing students' errors can help teachers improve instruction and enhance students' understanding of mathematics (Julian et al., 2016).

Errors in solving mathematical problems can stem from several factors, including

a lack of conceptual and procedural knowledge. Conceptual knowledge consists of facts and properties, ensuring that all information is interconnected. Procedural knowledge, on the other hand, consists of two components: (1) the formal language or symbols representing mathematical systems and (2) the sequence of algorithms or steps used to solve mathematical problems. Difficulties in applying mathematical concepts contribute to errors in problem-solving (Subanji, 2007).

Ramlah et al. (2016) identified several types of conceptual errors students make when solving algebraic problems: (1) errors in moving or omitting negative signs, (2) factual errors, such as miswriting operation signs or failing to include necessary negative signs, and (3) principle errors, such as incorrectly adding or subtracting integers with algebraic expressions. Procedural errors include (1) mistakes in arithmetic operations, (2) errors in simplifying fractions, (3) incomplete procedural steps, and (4) careless mistakes. Furthermore, according to Khair et al. (2018), conceptual errors occur when (1) students are unable to choose the correct formula or forget the required formula, or (2) students select the correct formula but fail to apply it properly. Procedural errors, on the other hand, occur when (1) students deviate from the expected steps for solving a problem or (2) fail to simplify expressions, requiring additional steps.

According to Wijaya & Masriyah (2013), an error can be defined as a deviation from an established correct procedure. Ketterlin-Geller & Yovanoff (2009) describe error analysis as an investigation into "common mistakes" and "misconceptions" among learners. Similarly, Herholdt & Sapire (2014) define error analysis as the study of students' mistakes to identify possible explanations for these errors. Based on these descriptions, error analysis involves reviewing students' work to determine procedural mistakes and identify the underlying causes of their errors.

Errors in solving algebraic problems frequently occur among junior high school students. Recognizing this, the researcher conducted an interview with a mathematics teacher at SMP Negeri 3 Dampelas. The teacher confirmed that algebra is one of the most challenging topics for students, with common errors occurring in calculations, addition, subtraction, and other algebraic operations. Additionally, interviews with several students revealed that they continued to struggle with algebraic expression problems.

Based on this information, the researcher identified a need for further analysis of conceptual and procedural errors in solving algebraic expressions. Furthermore, the researcher found that no similar studies had been conducted at SMP Negeri 3 Dampelas. By documenting the types of student errors, this research can contribute to improving students' learning methods and serve as a valuable resource for educators to enhance mathematical instruction.

RESEARCH METHODOLOGY

This qualitative research approach explores the errors made by Class VII A students in solving algebraic expression problems. The subjects of this study were three Class VII A students from SMP Negeri 3 Dampelas during the 2022/2023 academic year. The selection of subjects was conducted by administering a written test consisting of two algebraic expression problems, as shown in Figures 1 and 2. The questions used had been validated and were taken from the book *A Collection of HOTS Questions with the COVID-19 Phenomenon* (Khabibah et al., 2020). After evaluating the students' answers, three students were chosen as research subjects based on the following criteria: (1) students who made the most mistakes in their answers, (2) students whose mistakes were diverse and varied, and (3) teacher recommendations.

Subsequently, interviews were conducted to analyze the types of errors made by students. Conceptual errors included mistakes in understanding concepts, principles, and

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facts, while procedural errors involved random work, arithmetic operation errors in algebraic expressions, and errors in simplifying algebraic expressions.

To ensure research accuracy, a credibility test was conducted using member checking. Data analysis followed the interactive model proposed by Miles et al. (2014), which includes data condensation, data display, and conclusion drawing/verification.

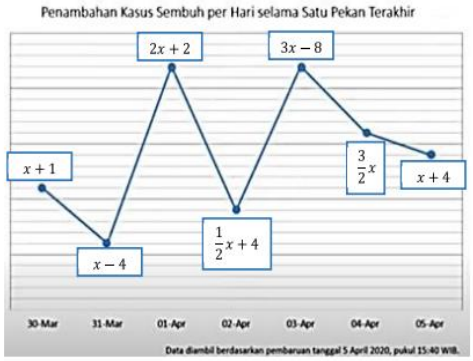
Diketahui data pasien meninggal akibat COVID-19 pada tanggal 5 April 2020 sebagai berikut:

Provinsi	Banyak Pasien Meninggal
Jawa Barat	x
DKI Jakarta	$5x-4$
Jawa Timur	$2x+6$
Banten	$x-5$
Jawa Tengah	$x+2$
Daerah Istimewa Yogyakarta	$\frac{1}{2}x-5$

Jika diketahui terdapat 120 pasien meninggal dari keenam provinsi di hari itu, tentukan banyaknya pasien meninggal di masing-masing provinsi!

Figure 1. First Question

Perhatikan diagram garis di bawah ini!



Jika diketahui pada tiga hari berturut-turut di mana ada dua hari dengan banyak pasien sembuh yang sama terdapat 53 orang pasien yang sembuh, tentukan banyak pasien sembuh pada tanggal 30 Maret!

Figure 2. Second Question

RESULTS AND DISCUSSION

The corrected answer sheets are then identified to group any errors made by students in solving algebraic problems. The results of grouping errors from 28 students are presented in Tables 1 and 2.

Table 1. Student Errors in Answering Question Number 1 .

No	Student Errors	Subject Code
1.	Error in adding like terms	AW, Z A, G P
2.	Error of principle	NA, A.F.
3 .	Doing anything	SN, NY, LI, AW, AY
4 .	Arithmetic operations on algebraic expressionss	FH ,AW , GP, Z A and FR
5 .	Write a negative sign in the calculation	RA and NA

Table 2. Student Errors in Answering Question Number 2

No	Student Error	Subject Code
1.	Working carelessly	GP, AW, ZA, SN and FH
2.	Simplifying algebraic fractions	AS , and ZA
3.	The concept of dividing fractions	US, FI, RA
4.	Writing a variable where there should not be a variable	GP and FR
5.	The concept of adding like terms	ZA, AW, GP
6	Error of principle	GP and ZA

Based on Table 1 and Table 2, three subjects were selected, coded AW, ZA, and GP. Subject AW was taken because he made the most mistakes, Subject ZA was taken because he made different mistakes and subject GP was a recommendation from the mathematics subject teacher. Other considerations for the three subjects can be communicated well. Furthermore, to facilitate the process of analyzing written data and interview results, the author provides the following codes: AW11 means subject AW for the first question first mistake. The symbol "P" and the subject is given the symbol "S". The last two digits are numbers that indicate the line in the interview transcript, for example, SAW02 indicates Subject AW, the second interview sequence.

AW's Error Analysis on Question Number 1

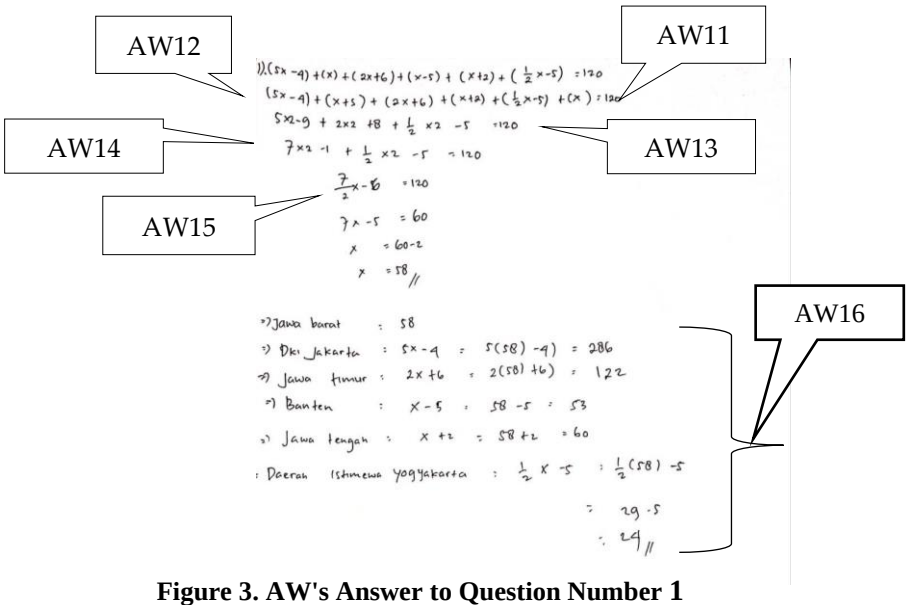


Figure 3. AW's Answer to Question Number 1

In Figure 3, six errors were found (AW11, AW12, AW13, AW14, AW15, AW16). There is an error in adding like terms [AW 11, AW12, AW13, AW14 and AW15], namely $(5x - 4) + (x + 5) + (2x + 6) + (x + 2) + (\frac{1}{2}x - 5) + (x) = 5x2 - 9 + 2x2 + 8 + \frac{1}{2}x\,2 - 5$, and carelessly completing the test [AW 16]. Subject AW can answer all questions but still provides incorrect responses. An interview was conducted to obtain further information, as shown in Table 3.

Table 3. Transcript of AW Interview on Question Number 1

Code		Interview Conversation
P001	:	Explain how you get the answer to question 1?
SAW002	:	Write down all the known equations before, I equals 120
P003	:	Ok, why is the equation equal to 120?
SAW004	:	Ever been taught like this.
P005	:	Ok, why did you rewrite a different equation?
SAW006	:	I arranged the **same numbers, like (5*x* -4) + (*x* + 5), to make it easier to calculate**.
P007	:	Are you sure how to calculate it like that? After the same arrangement, what do you do?
SAW008	:	Sure, after that, I will calculate the ones with variables first, then I will calculate the ones with only numbers.
P009	:	Ok. Why is the answer here (5 *x* -4) + (*x* +5) the result is 5 *x* 2-9 and so on?

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SAW010	:	**Because 5 x + x is the same as 5 x 2, because x + x is the same as x 2, and -4 + 5 is -9.**
P011	:	Are you sure that's the answer?
SAW012	:	I'm sure because I've also studied it like this after I got the value of x , I entered it into the requested equation.

Based on the interview results in Table 3, it can be seen that the subjects made mistakes in adding similar terms, made mistakes in simplifying algebraic fractions, and did random calculations.

AW's Error Analysis on Question Number 2

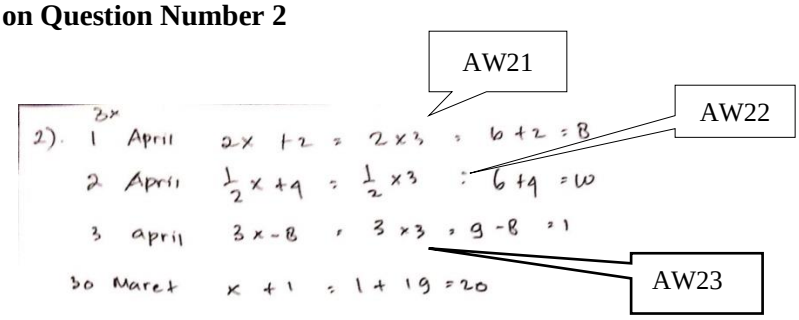

Figure 4. AW's Answer to Question Number 2

In Figure 4, based on [AW21], [AW22], and [AW23], each equation is substituted with $x = 3$ without showing the process. It is possible that the subject simply guessed the answer. Furthermore, the researcher conducted an interview to obtain more information about the types of errors made by AW, as shown in Table 4.

Table 4. Transcript of AW Interview on Question Number 2

Code		Interview Conversation
P013	:	Next, number 2, try to explain your answer.
SAW014	:	**First, I determine the x, that is, I get 3x**
P015	:	Where did you get the 3x?
SAW016	:	From what mother taught.
P017	:	OK, then you get x which is 3x, then why 2x + 2 = 2 x 3 = 6 + 2 = 8, how did you get an answer like that?
SAW018	:	So, I already got 3x *'s* , so I entered the remainder and removed the x 's, the remaining 3, so I got a result like that.
P019	:	I asked again, where you got it from? $\frac{1}{2}$ x 3 = 6 + 4 = 10?
SAW020	:	**It's there $\frac{1}{2}$ x + 4, so I put in the value of x which is 3 and I get that, $\frac{1}{6}$ + 4 so the result is 6 + 4 = 10.**
P021	:	Are you sure it's $\frac{1}{6}$ the same as 6?
SAW022	:	**Sure because $\frac{1}{6}$ is the same as 6 divided by 1 the result is 6.**
P023	:	How can you get the answer that March 30th is 20?
SAW024	:	As far as I know, that's the answer to everything I do.
P025	:	Are you sure that's the answer?

Based on the results of the error analysis on AW's answer to question number 2, it was concluded that the error made by the subject was a procedural error. The subject made a mistake in working on the question, the subject worked carelessly without paying attention to the multiplication and division work .

ZA's Error Analysis on Question Number 1

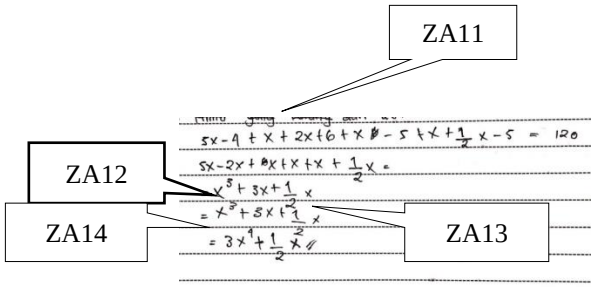

Figure 5. ZA's Answer to Question Number 1

As shown in Figure 5, errors [ZA11], [ZA12], [ZA13], and [ZA14] occurred in adding like terms, particularly in writing the answer $(5x - 4) + (x) + (2x + 6) + (x - 5) + (x) + (\frac{1}{2}x - 5) = 5x - 2x + x + x + x + \frac{1}{2}x$. A calculation error in algebraic expressions was also observed, as ZA wrote $5x - 2x = x^3$. The researcher conducted an interview to obtain further information, as presented in Table 5.

Table 5. ZA Interview Transcript on Question Number 1

Code		Interview Conversation
P027	:	Explain your answer to number 1.
S ZA028	:	First I wrote down all the equations and equaled them to 120.
P029	:	Why is it equal to 120?
S ZA030	:	In the question, 120 patients died from all six provinces, so I equaled the 6 equations to 120.
P031	:	Okay, so how do you do it next?
S ZA032	:	then add and subtract numbers that can be added and subtracted such as -4+2 the result is -2. And 6-5 is 1 but the number 1 can also not be written. **That's why my answer is $5x - 2x + x + x + x + \frac{1}{2}x$.**
P033	:	Are you sure you can do it like that?
S ZA034	:	Sure, because that's what I do
P035	:	Ok, how do I get the next answer?
S ZA036	:	The second step is to explain again the similarities
P037	:	How do you explain it?
S ZA038	:	**I explained the first equation $5x - 2x$ and the result was x^3, after that $x + x + x$ is equal to $3x$, and there are still equations that $\frac{1}{2}x$. I wrote down again.**
P039	:	How do you know that $5x - 2x$ is the same as x^3.
S ZA040	:	**because 5-2 is 3 and there is a variable x then I write x^3.**
P041	:	Are you sure that's how it works?
S ZA042	:	Sure
P043	:	Ok, what is the final result that you got?
S ZA044	:	**Next, explaining everything, $x^3 + 3x$, the result is $3x^4$ because in the root of the variable x there are 2 roots, namely 3 and 1, so I add $3 + 1 = 4$, getting $3x^4 + \frac{1}{2}x$.**
P045	:	Are you sure that's the final result?
S ZA046	:	I'm sure, that's why I work alone.

Based on Table 5, the subject's errors can be seen in adding like terms and performing arithmetic operations in the algebraic expressions of problem number 1. This

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indicates a conceptual error as well as a procedural error, specifically in arithmetic operations.

ZA's Error Analysis on Question Number 2

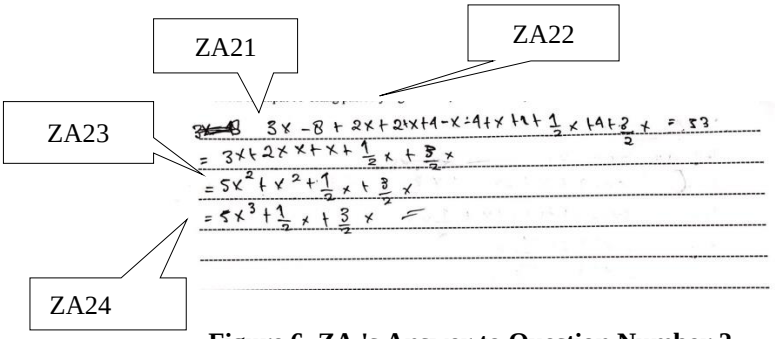

Figure 6. ZA 's Answer to Question Number 2

In Figure 6, ZA wrote the addition of like terms as follows: $3x + 2x + x + x + \frac{1}{2}x + \frac{3}{2}x = 5x^2 + x^2 + \frac{1}{2}x + \frac{3}{2}x$. Additionally, a principle error was identified, as ZA was unable to provide a final answer. ZA's final answer for question number 2 was written as $5x^3 + \frac{1}{2}x + \frac{3}{2}x$. ZA also made a procedural error when writing $3x - 8 + 2x + 2 + x + 4 - x - 4 + 1 + \frac{1}{2}x + 4 + \frac{3}{2}x = 53$, which was incorrectly simplified to $3x + 2x + x + x + \frac{1}{2}x + \frac{3}{2}x$. This error reflects a disorganized approach to problem-solving. The following is an excerpt from the researcher's interview with ZA, as shown in Table 6.

Table 6. ZA Interview Transcript on Question Number 2

Code		Interview Conversation
P0 48	:	Explain the process of getting the answer to question number 2!
S ZA049	:	Same as number 1, I wrote the equation again
P050	:	How do you write the equation?
S ZA051	:	First I looked at the chart which had the same height, like 2*x*+2 and 3*x* -8, they are parallel, so I wrote the equation for that first.
P052	:	After writing all the equations, what is the next process?
S ZA053	:	I add and subtract all terms like, like 4- *x* - 4+ *x*.
PO54	:	Are you sure that's how it works?
S ZA055	:	I'm sure, because I work alone.
P056	:	How do you get the result that $3x + 2x = 5x^2$?
S ZA057	:	**I add 3 + 2 first, the result is 5, after the *x variable* there are 2 of 3*x* and 2*x* so *x* + *x* = x^2. So the answer to 3*x* + 2*x* is $5x^2$**
P058	:	Are you sure that's how to add it?
S ZA059	:	I'm sure, because we've studied it.
P060	:	Ask again how to get the final answer.
S ZA0 61	:	**That's all I can do, I don't know the rest**

In Table 6, it is concluded that the conceptual errors made by the subject included incorrect addition of like terms, mistakenly adding variables with exponents that should not have been used, and an inability to determine the final answer. The procedural errors included failing to write the sequential steps for solving the problem and not completing the necessary steps to reach the final answer.

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GP's Error Analysis on Question Number 1

Based on the answer in Figure 7. subject GP made a mistake in performing arithmetic operations on algebraic expressionss, because GP wrote 8*x* + (-4 *x*) the result was -12 *x* . Another mistake, the subject made a mistake in adding like terms. This can be seen from GP writing $x + 1 + 5x - 4 + 2x + 6 + x - 5 + x + 2 + \frac{1}{2}x - 5 = x + 1x + 8x + (-4x) + 3x + \frac{5}{2}x$.

Based on the answer in Figure 7, subject GP made an error in performing arithmetic operations on algebraic expressions, as GP wrote $8x + (-4\,x)$ and obtained -12 *x* as the result. Another mistake involved the incorrect addition of like terms, as seen in GP's writing of $x + 1 + 5x - 4 + 2x + 6 + x - 5 + x + 2 + \frac{1}{2}x - 5 = x + 1x + 8x + (-4\,x) + 3x + \frac{5}{2}x$.

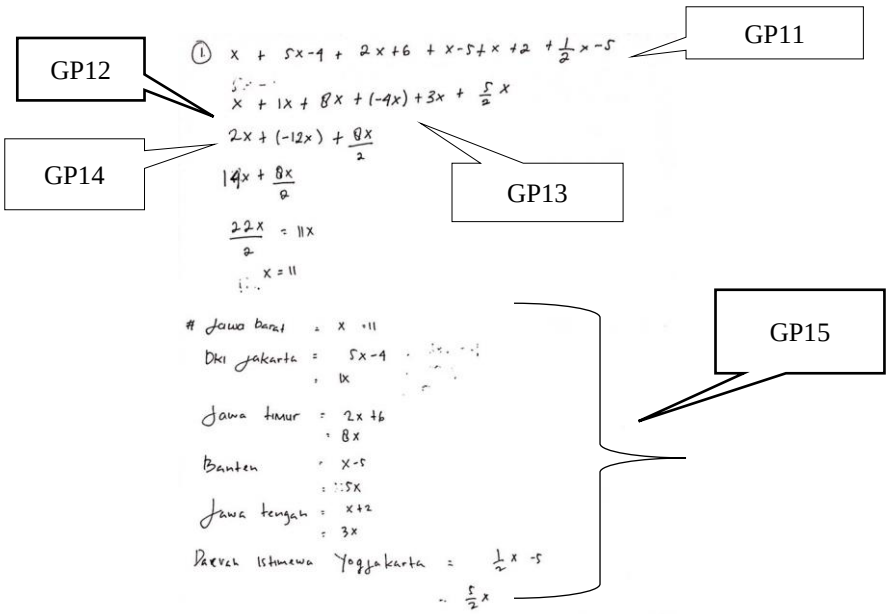

Figure 7. GP 's Answer to Question Number 1

Next, the researcher conducted interviews to analyze the types of errors made by GP, as shown in Table 7 below. Based on the interview results, it was concluded that the subject made mistakes in adding like terms, indicating a conceptual error. Additionally, the subject did not complete the necessary steps on the answer sheet, which constituted a procedural error.

Table 7. GP Interview Transcript on Question Number 1

Code		Interview Conversation
P0 62	:	Can you please explain your answer to number 1?
SGP0 63	:	Okay, first I'll write down all the equations.
P0 64	:	After you wrote all the equations, what did you do next?
SGP0 65	:	**Next, I calculate all the equations, such as $5x - 4$, the result is $1x$, because 5-4 is 1 and there is still the variable *x* , and so on.**
P0 66	:	Are you sure that's how it works?
SGP0 67	:	Sure
P0 68	:	How do you know that it's done like that?
SGP0 69	:	Then, my mother once taught me about adding variables like this.

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P0 70	:	ok, how do you get that 8 *x* +(-4 *x*) is -12*x* ?
SGP0 71	:	**because 8 + 4 is 12, right? There is a negative sign at 4 so the result is -12 and there is the variable *x* so the result is -12*x* .**
P0 72	:	Are you sure the answer is like that?
SGP0 73	:	Sure.
P0 74	:	After you get the *x* value, what do you do?
SGP0 75	:	After I got the value of *x*, I tried to enter the equation requested by the question, such as *x* is 11 because the value of *x* is 11.
P0 76	:	Then why is the next answer different? Why didn't you put the value of x as 11? Why did you immediately answer 5 *x* - 4 is 1 *x* ?
SGP0 77	:	**Because 5 *x* - 4 has a subtraction sign, so I did it straight away, because there is only one x, so I immediately answered that *x* is 11, because there are no other equations.**

GP's Error Analysis on Question Number 2 .

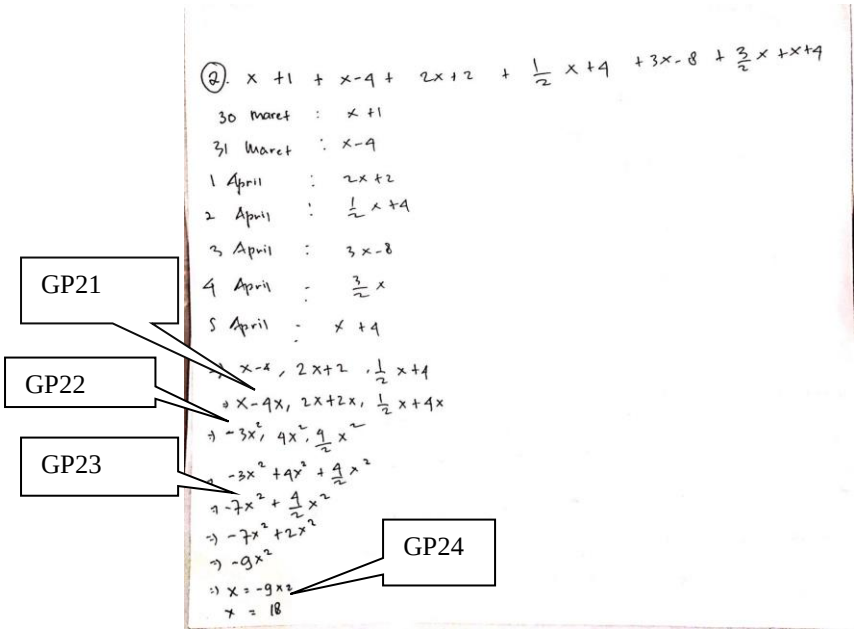

Figure 8. GP's Answer to Question Number 2

Based on Figure 8, GP incorrectly wrote $x-4, 2x+2,\ 1/2\,x\ +\ 4$ as $x-4x, 2x+2x, \frac{1}{2}x\ +\ 4x$ and obtained the result $-3x^2, 4x^2, \frac{4}{2}x^2$. The next mistake made by GP was an error in adding like terms, writing $x-4x+2x+2x+\frac{4}{2}x^2$. A similar error was observed when working on on $-3x^2+4x^2+\frac{4}{2}x^2$. GP included a variable that should not have been there and incorrectly rewrote $x-4, 2x+2, \frac{1}{2}x+4$ as $x-4x, 2x+\ 2x, \frac{1}{2}x+4x$. GP obtained x = 18, but the value of x was not substituted back into the equation as required by the question. As a result, GP could not determine the correct final answer. Next, the researcher conducted further interviews to analyze the types of errors made by GP, as presented in Table 8.

Table 8. GP Interview Transcript on Question Number 2

Code		Interview Conversation
P080	:	Explain your answer to number 2?
S GP081	:	First I wrote down all the equations of March 30, March 31, April 1, April 2, April 3, April 4 and April 5 separately.
P082	:	After that what do you do?
SGP083	:	Next I enter an equation like March 30th is equal to *x* + 1 and so on.
P084	:	ok what do you do next?
SGP085	:	After that I separated the equations for March 31, April 1 and April 2 again to work on.
P086	:	why separate? Are the other equations not done?
SGP087	:	I separated it so that it would be easier to find the *x* , and why didn't I enter March 30th because in the question March 30th was asked.
P088	:	Okay. Ade wrote $x-4, 2x+2, \frac{1}{2}x+4$ equals $x-4x\,, 2x+2, \frac{1}{2}x+4\,x$. Why add the variable *x* in the next answer.
SGP089	:	**Add the variable *x* to make it easier to work with.**
P090	:	Are you sure you do it that way?
SGP091	:	sure, because I looked for this myself.
P092	:	Okay, in the next answer, Ade wrote $x-4x$ equals -$3x^2$, why did he add them like that?
SGP093	:	**Are you sure, because in front of *x* there is a 1 that is not written, so the result of 1-4 is -3 and there are two *x variables in 1 x* and in 4 *x*, so the result is -3 x^2 and so on.**
P094	:	OK, in your final answer you wrote that x is equal to -9x^2 and the result is *x* is equal to 18, how do you know that the answer is like that?
SGP095	:	**Previously, I worked out all the equations for March 31, April 1 and April 2, after that I added them up and the final result was *x* equals $-9x^2$, so I multiplied -9 by 2 so the final result was *x* equals 18.**
P096	:	Are you sure the final answer is like that?
SGP097	:	Yes, because this is my own answer and I did it myself
P098	:	Next, if you have got the value of *x*, what do you do to get the answer to the question asked ?
SGP099	:	***x* was actually entered into the equation for March 30, I didn't write it down, I just worked on it until I got the value of *x* .**

The subject did not write the sequential steps in the problem-solving process, and the final answer was incomplete. It was observed that the subject included variables that should not have been there and made errors in adding like terms.

Based on the analysis of the interview data, the types of errors made by the subject in solving algebraic problems were identified as conceptual errors and procedural errors. A detailed discussion of these errors is presented below.

Conceptual Errors

The following are the types of conceptual errors that occur in the subject's work when solving problems related to algebraic expressions.

Error in Concepts

Conceptual errors made by students include mistakes in adding like terms. These errors were observed in question number 1, where AW, ZA, and GP made similar mistakes. AW wrote the answer as $(5x-4)+(x+5)+(2x+6)+(x+2)+(\frac{1}{2}x-5)+(x)=5x2-9+2x2+8+\frac{1}{2}x2-5$. ZA wrote the answer as $(5x-4)+(x)+(2x+6)+$

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$(x-5)+(x)+\left(\frac{1}{2}x-5\right)=5x-2x+x+x+x+\frac{1}{2}x$. Similarly, GP made an error by writing $x+1+5x-4+2x+6+x-5+x+2+\frac{1}{2}x-5=x+1x+8x+(-4x)+3x+\frac{5}{2}x$.

Conceptual errors in adding like terms were also made by ZA and GP in question number 2. ZA wrote $3x+2x+x+x+\frac{1}{2}x+\frac{3}{2}x=5x^2+x^2+\frac{1}{2}x+\frac{3}{2}x$, while GP wrote $x-4x+2x+2x+\frac{4}{2}x^2$ as equivalent to $-3x^2+4x^2+\frac{4}{2}x^2$. These conceptual errors align with the findings of Dewi (2014), who stated that one of the common conceptual errors made by students is the incorrect addition of like terms in algebraic expressions. This type of mistake occurs because students do not fully understand addition in algebraic expressions and the properties of addition operations.

Errors in Principles

A principal error made by students is the inability to draw conclusions from the final answer. This error was observed in question number 2, where both ZA and GP made similar mistakes. ZA's final answer was $5x^3+\frac{1}{2}x+\frac{3}{2}x$, but they failed to provide a conclusion based on the question's requirements. Similarly, GP's final answer was x = 18; however, despite determining the value of xx, GP did not substitute it back into the equation as required by the problem. These findings align with Heppinia and Tiya (2019), who stated that principal errors occur when students write incorrect conclusions that do not align with the question, provide conclusions that do not match the given problems, or fail to restate the final results of their solutions.

Errors in Facts

A factual error made by students is the incorrect inclusion of variables that should not be present. This error was made by GP in question number 2, where GP wrote $x-4, 2x+2, \frac{1}{2}x+4$. This mistake represents a factual error, as the subject included variables that should not have been there. This aligns with the findings of Mas'ud (2021), who stated that errors in writing and mistakes in operational signs are considered factual errors.

Procedural Errors

The following are the types of procedural errors that occur in the subject's work when solving problems related to algebraic expressions.

Working Carelessly

This error was made by student AW in question number 1, where AW wrote $x+x-5+x+5$ without following the correct steps. In question number 2, similar errors were made by AW, ZA, and GP. AW wrote $x=3$ without showing the steps taken to solve the problem. ZA wrote $3x-8+2x+2+x+4-x-4+1+\frac{1}{2}x+4+\frac{3}{2}x=53$, which was then incorrectly simplified to $x-4x, 2x+2x, \frac{1}{2}x+4x$. Similarly, GP wrote $x-4, 2x+2, \frac{1}{2}x+4$ as $x-4x, 2x+2x, \frac{1}{2}x+4x$ and obtained the incorrect result $-3x^2, 4x^2, \frac{4}{2}x^2$. This aligns with the findings of Fadzillah & Wibowo (2016), who stated that students make calculation errors due to rushing and a lack of accuracy. Additionally, errors caused by incorrect work procedures can lead to ambiguous solution steps (Surya et al., 2019; Mas'ud, 2021).

Arithmetic Operation Errors in Algebraic Expressionss

The arithmetic operation errors made by students included mistakes in addition, subtraction, multiplication, and division within algebraic expressions. These errors were observed in question number 1, where AW, ZA, and GP made similar mistakes. AW wrote $\frac{7}{2}x - 6 = 120$ and incorrectly rewrote it as $7x - 5 = 60$. ZA made an error by writing $5x - 2x = x^3$, while GP incorrectly wrote $x + 1x + 8x + (-4x) + 3x + \frac{5}{2}x = 2x + (-12x) + \frac{8x}{2} = 14x + \frac{8x}{2}$. Additionally, GP miscalculated $8x + (-4x)$, incorrectly arriving at $-12x$ instead of the correct result. This aligns with Widyasmara's (2020) statement that students often make calculation errors due to a lack of accuracy.

Error in Simplifying Algebraic Expressions Involving Fractional Coefficients

The error in simplifying algebraic fractions into simpler expressions was made by student ZA in question number 2, where they wrote $\frac{1}{2}x + \frac{3}{2}x$. The student made a mistake in simplifying the final answer when performing arithmetic operations with fractions. This aligns with Dewi's (2014) statement that students often make errors in writing final results due to a lack of carefulness, and some do not fully understand how to properly express the final answer, leading to incorrect results.

CONCLUSION AND SUGGESTIONS

Based on the results of the research and discussion, it was concluded that the types of errors made by students in solving algebraic problems at SMP Negeri 3 Dampelas were conceptual errors and procedural errors. Conceptual errors include mistakes in understanding concepts, principles, and facts. These errors involve misapplying the concept of adding like terms, failing to determine the final answer correctly, and making mistakes in writing variables. Procedural errors made by students include careless mistakes while solving problems, errors in arithmetic operations on algebraic expressions, and mistakes in simplifying algebraic expressions involving fractional coefficients.

Based on the discussion and conclusions, the researcher suggests that students should be more active in practicing algebraic exercises to minimize errors. Additionally, teachers should place greater emphasis on materials related to theorems and formulas to enhance students' conceptual understanding.

REFERENCES

Julian, R.S., Bennu, S., & Lefrida, R. (2016). Analisis kesalahan siswa kelas viii smp negeri 19 palu dalam menyelesaikan soal operasi pecahan bentuk aljabar. *Jurnal Elektronik Pendidikan Matematika Tadulako*, *4*(2), 248-262. http://jurnal.untad.ac.id/jurnal/index.php/JEPMT/article/view/8438.

Dewi, S. I. K (2014). Analisis kesalahan siswa kelas viii dalam menyelesaikan soal pada materi faktorisasi bentuk aljabar smp negeri 1 kamal semester gasal tahun ajaran 2013/2014. *MATHEdunesa*, *3*(2). https://ejournal.unesa.ac.id/index.php/mathedunesa/article/view/8724

Fadzillah, N., Wibowo, T. (2016). Analisis kesulitan pemahaman konsep matematika siswa kelas VII SMP. *Ekuivalen-Pendidikan Matematika, 20(2),* 140-144. https://doi.org/10.37729/ekuivalen.v20i2.2888.

Heppinia, M., & Tiya, K. (2015). Analisis kesalahan siswa kelas vii smp negeri 1 wawotobi dalam menyelesaikan soal-soal pecahan. *Jurnal Penelitian Pendidikan Matematika*, *3*(3), 27-40. https://ojs.uho.ac.id/index.php/JPPM/article/view/3018.

https://dx.doi.org/10.26594/jmpm.v9i2.3509

Herholdt, R., & Sapire, I. (2014). An error analysis in the early grades mathematics a learning opportunity. *South African Journal of Childhood Education*, 4(1), 42-60. https://files.eric.ed.gov/fulltext/EJ1187143.pdf.

Ketterlin-Geller, L. R., & Yovanoff, P. (2009). Diagnostic assessments in mathematics to support instructional decision making. *PARE: Practical Assessment, Research, and Evaluation*. *14*(*16*). https://doi.org/10.7275/vxrk-3190.

Khabibah, S, Manoy, J.T., Rosyidi, A.H., Kurniasari, I., & Setianingsih, R. (2020). *Kumpulan soal highher order thinking skills (hots) dan pembahasan untuk siswa SMP berbasis fenomena covid-19*. Surabaya: Unesa University Press.

Khair, M. S., Subanji, S., & Muksar, M. (2018). Kesalahan konsep dan prosedur siswa dalam menyelesaikan soal persamaan ditinjau dari gaya berpikir. *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan*, *3*(5), 620-633. http://dx.doi.org/10.17977/jptpp.v3i5.11074.

Miles, M.B., Huberman, A.M, & Saldana, J. (2014). *Qualitative data analysis, a methods sourcebook (3rd ed.).* SAGE Publication.

Nurrahman, A. (2015). Ada apa dengan berpikir aljabar dalam belajar. In *Seminar Nasional Matematika Dan Pendidikan Matematika* (pp. 105-108).

O'brien, A., & Ríordáin, M. N. (2017). Examining difficulties in initial algebra: Prerequisite and algebra content areas for Irish post-primary students. In *CERME 10*. https://hal.science/hal-01949265v1.

Ramlah, R., Bennu, S., & Paloloang, B. (2016). Analisis kesalahan siswa dalam menyelesaikan soal penjumlahan dan pengurangan pecahan di kelas vii smpn model terpadu madani. *JIPMat*, *1*(2), 182-194. doi:10.26877/jipmat.v1i2.1245.

Mas'ud, S. (2021). Analisis kesalahan fakta dan kesalahan konsep mahasiswa dalam menyelesaikan soal geometri analitik ruang. *Didaktika: Jurnal Kependidikan*, *14*(2), 147-162. http://dx.doi.org/10.30863/didaktika.v14i2.909

Saputro, B. A, Suryadi, D., Rosjanuardi, R., & Kartasasmita, B.G. (2018). Analysis of students errors in responding to timss domain algebra problem. *Journal of Physics: Conference Series, 1088(1),* 012031. https://doi.org/10.1088/1742-6596/1088/1/012031.

Subanji, 2007. *Proses berpikir pseudo penalaran konvariasional mahasiswa dalam mengonstruksi grafik fungsi kejadian dinamik*. In Disertai. Surabaya: PPS Unesa.

Surya, I. T. M., Suastika, I. K., & Sesanti, N. R. (2019). Analisis kesalahan siswa dalam menyelesaikan soal-soal materi operasi bentuk aljabar berdasarkan tahapan Newman di kelas VII SMP NU Bululawang. *Rainsstek: Jurnal Terapan Sains & Teknologi*, *1*(1), 25-33. https://doi.org/10.21067/jtst.v1i1.3058.

Widyasmara, L. N. (2020). Analisis kesalahan siswa dalam menyelesaikan soal bentuk aljabar kelas VII berdasarkan teori nolting. In Disertasi. Malang: Universitas Negeri Malang.

Wijaya, A. A., & Masriyah, (2013). Analisis kesalahan siswa dalam menyelesaikan soal cerita persamaan linear dua variabel. *MATHEdunesa, 2(1).* https://doi.org/10.26740/mathedunesa.v2n1.p%25p.