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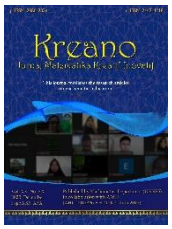

Misconceptions of Quitters Students in Solving Algebra Problems Using a Two-Tier Multiple Choice Diagnostic

Adinda Dwi Raysha Adis Kusuma[1], Indah Wahyuni[1]

[1]UIN Kiai Haji Achmad Siddiq Jember

Correspondence should be addressed to Adinda DRA Kusuma: adindadwirao1@gmail.com

Abstract

Understanding students' misconceptions about algebra material is essential to determine corrective steps, so students avoid making continuous errors in learning algebra. This study used a qualitative approach to identify students' misconceptions about solving algebraic problems, especially quitters. The subjects in this study were class VII students of SMP Argopuro Panti who were included in the quitters' type. The instruments used were an adversity quotient questionnaire, a two-tier multiple-choice diagnostic test instrument, and an interview guide. The results of this study are in the form of misconceptions by quitters students, namely: 1) in working on subtraction questions in algebraic forms, students only subtract the first term; 2) students experience misconceptions in operating numbers; 3) students experience misconceptions about patterns for algebraic exponents; and 4) students make conceptual errors in using the cross out system. To overcome this, teachers can provide accurate explanations, use appropriate learning models, and recall student prerequisite material before learning new material. By identifying students' misconceptions in solving algebraic problems, the teacher can correct and improve students' inaccurate understanding.

Keywords: Misconceptions; Quitters Students; Algebra; Two-Tier Multiple Choice Diagnostic.

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Abstrak

Memahami miskonsepsi siswa pada materi aljabar penting dilakukan agar dapat menentukan langkah perbaikan sehingga siswa tidak melakukan kesalahan yang berkelanjutan dalam pembelajaran aljabar. Penelitian ini menggunakan pendekatan kualitatif yang bertujuan untuk mengidentifikasi miskonsepsi siswa, khususnya siswa quitters, dalam menyelesaikan soal aljabar. Subjek dalam penelitian ini yaitu siswa kelas VII SMP Argopuro Panti yang termasuk dalam tipe quitters. Instrumen yang digunakan adalah angket adversity quotient, instrumen tes two-tier multiple choice diagnostic, dan pedoman wawancara. Hasil dari penelitian ini berupa miskonsepsi yang dilakukan siswa quitters, yaitu: 1) dalam mengerjakan soal pengurangan bentuk aljabar, siswa hanya mengurangi suku pertamanya saja; 2) siswa mengalami miskonsepsi dalam mengoperasikan bilangan; 3) siswa mengalami miskonsepsi mengenai pola untuk perpangkatan aljabar; dan 4) siswa melakukan kesalahan konsep dalam menggunakan sistem coret. Untuk mengatasinya guru dapat memberikan penjelasan yang akurat, penggunaan model pembelajaran yang tepat, serta mengingat kembali materi prasyarat siswa sebelum mempelajari materi baru. Dengan mengidentifikasi miskonsepsi siswa dalam mengerjakan soal aljabar, guru dapat melakukan upaya untuk mengoreksi dan memperbaiki pemahaman siswa yang kurang tepat.

INTRODUCTION

Mathematics plays a significant role and function in human life, both in the social, spiritual, health, and economic fields, as well as in advancing science and technology. Almost every activity carried out by humans cannot be separated from mathematics in it. The importance of mathematics makes Sunita Yadav, in the article he wrote to say that "without mathematics, there can be neither science nor engineering" (Yadav, 2019).

In its development, the branch of mathematics is independent and does not depend on other disciplines. Mathematics is an essential tool in applying and developing other fields of science or in the development of mathematics itself. Therefore, mathematics is the queen of science in education. This follows what Kaushik Das wrote: "Mathematics as a science-based course or discipline is known as a queen of all subjects" (Das, 2019).

Understanding mathematics well is very important to study various disciplines so that mathematics is taught at almost all levels of education (Kulsum et al., 2019). In addition, mathematics has the function of expanding the ability to convey ideas using language through various mathematical models, such as sentences and mathematical equations, diagrams, graphs, or tables. (Rahmah, 2018). Mathematics learning aims to help students deal with various mathematics-related problems in everyday life. Realizing the importance of the role of mathematics, students are expected to be able to understand mathematics well.

However, according to the 2018 PISA report, the mathematical abilities of Indonesian students scored 379 and ranked 73rd (OCED, 2019). This score describes Indonesian students' level of understanding and mastery of mathematics, which is classified as very low. This condition is concerning because many countries have better mathematical abilities than Indonesia. Therefore, it is necessary to take action to improve the quality of mathematics education in Indonesia.

One field in mathematics that is important for students to understand and is closely related to everyday life is algebra. Marpa explained, "Algebra is a branch of mathematics, which turns relations examined by using symbols and numbers to generalized equations" (Marpa, 2019). Algebra can also be interpreted as a field of mathematics that uses mathematical statements to describe the relationship between various objects.

"Algebra is considered by many to be the mathematical gatekeeper, and mastering algebra skills gives students a

passport to educational opportunities and an expansive job market" (Bone et al., 2021; Ralston et al., 2018). The sentence states that algebra is a necessary foundation or fundamental in mathematics. Therefore, understanding and mastering algebra is a crucial initial stage in studying further mathematics. Students with a good understanding of algebra can study more complex mathematical topics, solve problems, and develop the logical thinking abilities needed in various academic and professional contexts.

However, in reality, not all students easily understand algebra material. Several Argopuro Panti Middle School students needed help understanding basic concepts, resulting in repeatedly making the same errors. For example, students needed help understanding the basic rules regarding algebraic subtraction operations. So that in solving equations, there were students who made errors such as removing brackets in deductions without multiplying each term in it by a negative sign. Errors experienced by these students, if not handled properly, can result in students experiencing difficulties in learning more complex algebraic concepts. Errors made by these students can be caused by several things, such as a lack of understanding of concepts, confusion in applying formulas, and lack of practice.

Internal and external factors of students can also affect the learning difficulties or obstacles experienced by students. Internal factors refer to factors that come from within the student, while external factors refer to factors that come from outside the student. "Internal factors consist of physical, psychological, and health factors. External factors consist of family, school, and community" (Tokan & Imakulata, 2019).

To face difficulties in working on algebraic math problems, an adversity quotient is needed to overcome them. "Adversity quotient measures people's ability to withstand setbacks, get rid of adversity, and surpass difficulties" (Qin et al., 2019). A high adversity quotient increases the possibility of individuals having an optimistic and innovative attitude when facing problems (Hidayat et al., 2018). Conversely, if the adversity quotient of someone is low, it is assumed they tend to give up easily, avoid challenges, and experience high-stress levels. (Huda & Damar, 2021).

In the adversity quotient, three types are given: climbers, campers, and quitters (Pradika et al., 2019). The climbers' type describes individuals who dare to face challenges in solving problems or matters and are ready to take the necessary risks. The campers type refers to individuals who desire to face challenges but remain consistent in not taking or accepting risks. Meanwhile, the quitters' type refers to individuals who lack the motivation to face challenges, tend to avoid them, quickly feel hopeless, and often give up. (Gaffar et al., 2021).

Therefore, the role of the teacher is needed to help students, especially quitters, understand mathematics in algebraic material. The role of a teacher is focused on more than teaching activities alone. However, it is also responsible as a full manager in implementing the teaching and learning process in the classroom (Buchari, 2018). One method that teachers can do is to analyze students' misconceptions of algebra material. Students are said to need clarification when students have an accurate understanding. Al-Mutawah et al. also explained, "When students systematically use incorrect rules or the correct rule in an inappropriate domain, there are likely to be misconceptions" (Al-Mutawah et al., 2019).

Analyzing students' misconceptions has significant benefits in an educational

context. Teachers can find out students' misconceptions so that the teacher can design appropriate learning strategies and models. Involving students actively in the learning process that focuses on correct understanding and analyzing students' misconceptions can also improve their learning outcomes.

Several researchers have discussed the analysis of students' misconceptions in learning mathematics, as in research conducted by Mahfuzhoh, who discussed the analysis of junior high school students' misconceptions about integer material. (Mahfuzhoh, 2019). In addition, Jitu Halomoan Lumbantoruan and Hendrikus Male also conducted research on the analysis of students' misconceptions in the mathematics education study program on probability theory on essay problems. (Lumbantoruan & Male, 2020). After considering the previous description, the researcher believes that recognizing students' misconceptions is crucial to increase their learning success.

This study takes the subject of algebra as the research subject—namely, quitters-type students. A two-tier multiple-choice diagnostic evaluation technique will be used to identify the misconceptions made by quitters in solving algebraic problems. Thus, the researcher took the research title "Misconceptions of Quitters Students in Solving Algebraic Problems Using a Two-Tier Multiple Choice Diagnostic."

METHOD

This research was conducted at SMP Argopuro Panti, which is located at Lapangan Street No. 39, Panti, Panti District, Jember Regency, East Java. The school research was collected over two days, from 22 May 2023 to 23 May 2023, from 07:00 to 08.10 WIB. This study applied a qualitative approach. Qualitative research was chosen because this research will explain the misconceptions of quitters students in solving algebraic problems using a two-tier multiple-choice diagnostic.

The research procedure was to identify the problem first, then formulate the objectives. This research aims to find and identify the misconceptions made by quitters in solving algebraic problems.

Next is to determine the research subjects used. The subjects in this study were class VII students of SMP Argopuro Panti who were included in the quitters' category. Based on the results of the adversity quotient questionnaire, it was found that 5 class VII students of SMP Argopuro Panti were included in the quitters' category and were the subjects of this study.

Then the research subjects were given a two-tier multiple-choice diagnostic test on algebra material. From the results of these tests, students who had misconceptions were interviewed about why they had them. Data in the form of two-tier multiple-choice diagnostic test results, interviews, and observations that have been carried out are processed and analyzed; conclusions are drawn (see Figure 1).

The instrument in this research is the researcher as the main instrument. In addition to the main instrument, three supporting instruments were used: an adversity quotient **questionnaire** to determine the research subject, a two-tier multiple-choice diagnostic **test** on algebraic material, and **an interview guide**. The methods used in the data collection process were tests, interviews, and observations. In contrast, in the data analysis process, three stages are carried out: data condensation, data presentation, and drawing conclusions.

To validate the data, the researcher did the triangulation method. Research-

ers collected data using various methods, namely diagnostic tests, interviews, and field observations. This is done to get a variety of points of view and complement one another.

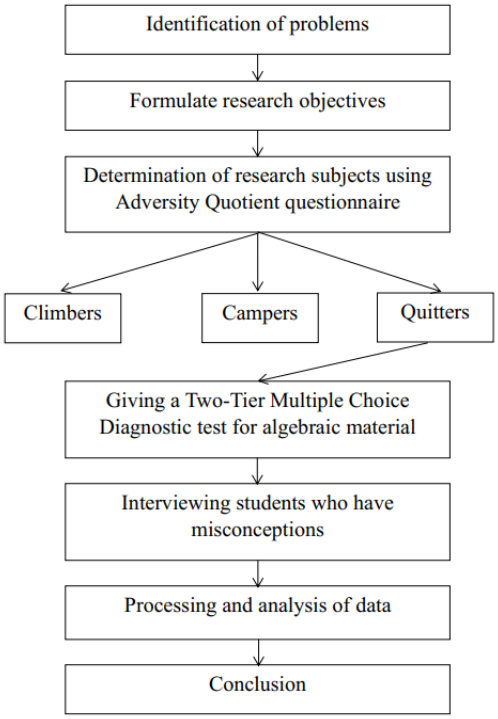


Figure 1. A flow chart regarding research procedures

RESULTS AND DISCUSSION

Results

This research used a two-tier multiple-choice diagnostic instrument to identify quitters' misconceptions in solving algebraic problems. This diagnostic test consists of 5 questions covering five concepts: addition, subtraction, multiplication, exponents, and division in algebra. The test results grouped students' answers into three categories: understanding concepts, misconceptions, and not understanding concepts.

Students are included in the understanding category if the student can choose the correct answer at the first level and the right reason at the second level. Students are included in the misconceptions category if the student can choose the correct answer at the first level but chooses the wrong reason at the second level or students who choose the wrong answer at the first level. However, the student can choose the right reason at the second level. In comparison, students are included in the not understanding category if students choose the wrong answer at the first level and the wrong reason at the second level (Syaifuddin et al., 2022).

The test results of quitters-type students working on algebraic questions using the two-tier multiple-choice diagnostic test instrument are presented in the following table.

Table 1. Student test results using a two-tier multiple-choice diagnostic

Student	Question Number		
	A (T-T)	B (T-F/F-T)	C (F-F)
UH	3, 4	5	1, 2
LFNJ		3	1, 2, 4, 5
DHA	1, 3	2, 5	4
DKA	3, 4	5	1, 2
AZM	1, 3	2, 4	5

A: Understanding; B: Misconception; C: Not understanding

From Table 1, one student's answer was taken for each number of questions that experienced misconceptions for further analysis.

Misconceptions about Number 2

In question number 2, students were given problems regarding algebraic subtraction operations. Two students needed clarification in working on this problem, namely DHA and AZM. For example, in the results of DHA work, he chose the wrong answer at the first level, but the reason chosen was correct at the second level.

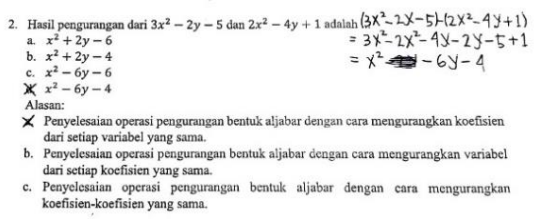

2. Hasil pengurangan dari $3x^2 - 2y - 5$ dan $2x^2 - 4y + 1$ adalah
a. $x^2 + 2y - 6$
b. $x^2 + 2y - 4$
c. $x^2 - 6y - 6$
✗ $x^2 - 6y - 4$
Alasan:
✗ Penyelesaian operasi pengurangan bentuk aljabar dengan cara mengurangkan koefisien dari setiap variabel yang sama.
b. Penyelesaian operasi pengurangan bentuk aljabar dengan cara mengurangkan variabel dari setiap koefisien yang sama.
c. Penyelesaian operasi pengurangan bentuk aljabar dengan cara mengurangkan koefisien-koefisien yang sama.

Figure 2. Students misconceptions in solving problem number 2.

The following is an excerpt of the researcher interview (P) with DHA.

P : What was your first step when solving question number 2?
DHA : I immediately cut it down, Miss. The instruction was ordered to subtract.
P : In subtracting, how do you do it?
DHA : By marking the min between the two, Ms. So $3x^2 - 2y - 5 - 2x^2 - 4y + 1$. *After that, it is collected with those that have the same variables. Then do it, sis.*
P : Are you sure about your answer?
DHA : Sure, as far as I remember, miss.

The student can give good reasons that the step to solve the subtraction of algebraic forms is to subtract the coefficients of each same variable that is the same or terms that are similar. However, when working on these questions, students made errors when solving $-(2x^2 - 4x + 1)$. The student did not multiply each term by a negative sign; he only multiplied the negative sign on the first term.

Based on interviews with these students, it is known that in solving the subtraction of $3x^2 - 2y - 5$ and $2x^2 - 4y + 1$, the student only added a subtraction (negative) sign in between, so the student answers is $3x^2 - 2y - 5 - 2x^2 - 4y + 1$ as a solution step. This causes the results to be inaccurate because they need to follow the concepts accepted by experts. The errors made by these students were due to students needing an adequate understanding of the basic concepts of algebraic subtraction resulting in misconceptions in these students.

Misconceptions about Number 3

In question number 3, students were given problems regarding multiplication operations in algebraic forms. There was one student who had a misconception, namely LFNJ, in solving this problem. LFNJ chose the wrong answer at the first level, but the correct reason was chosen at the second level.

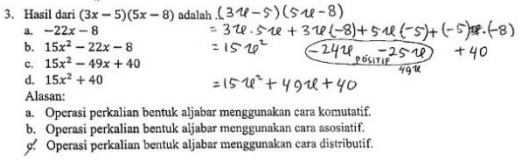

3. Hasil dari $(3x - 5)(5x - 8)$ adalah
a. $-22x - 8$
b. $15x^2 - 22x - 8$
c. $15x^2 - 49x + 40$
d. $15x^2 + 40$
Alasan:
a. Operasi perkalian bentuk aljabar menggunakan cara komutatif.
b. Operasi perkalian bentuk aljabar menggunakan cara asosiatif.
✗ Operasi perkalian bentuk aljabar menggunakan cara distributif.

Figure 3. Students misconceptions in solving problem number 3

The following is an excerpt of the researcher interview (P) with LFNJ.

P : What was your first step when solving question number 3?
LFNJ : I multiplied it using the distributive property, Miss.
P : In solving these questions, were there any confusion or obstacles?
LFNJ : I did not find my answer in your answer choices. When I did $-24x - 25x$, *I got the result of* $49x$, *not* $-49x$.
P : Are you sure if $-24x - 25 = 49x$?
LFNJ : I am sure the teacher once explained that if downbeat meets negative, the result is positive.

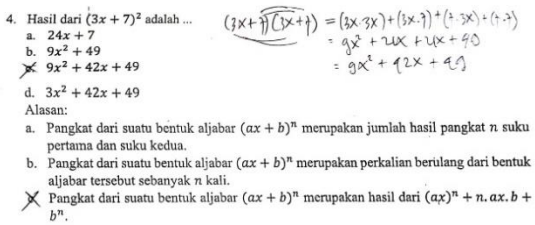
The student can give good reasons that the step to solve the multiplication of algebraic forms is to use the distributive method. In operating the multiplication of the algebraic form of the two terms with the two terms, the student used the distributive property correctly, namely by following the pattern $(ax + b)(cx + d) = ax.cx + ax.d + b.cx + b.d$. but the error made was when operating $-24x - 25x$ this student answered $49x$, instead of $-49x$.

Based on interviews with these students, given that they understand when operating $-a - b$ always resulted in posi-

tive answers, as was done in operating multiplication $(-a) \times (-b)$. However, operating $-a - b$ and $(-a) \times (-b)$ is different. This caused the final answers obtained by these students to be inaccurate because they were not by the concepts accepted by experts. The errors made by students in solving question number 3 were due to students' understanding and prerequisite skills for the material of arithmetic operations in algebraic forms that were not quite right.

Misconceptions about Number 4

In question number 4, students were given problems regarding the operation of exponential algebraic forms. In solving this problem, one student had a misconception, namely AZM. AZM chose the correct answer at the first level, but the reasons were chosen wrong at the second level.


4. Hasil dari $(3x + 7)^2$ adalah ...
a. $24x + 7$
b. $9x^2 + 49$
c. $9x^2 + 42x + 49$
d. $3x^2 + 42x + 49$

Alasan:
a. Pangkat dari suatu bentuk aljabar $(ax + b)^n$ merupakan jumlah hasil pangkat n suku pertama dan suku kedua.
b. Pangkat dari suatu bentuk aljabar $(ax + b)^n$ merupakan perkalian berulang dari bentuk aljabar tersebut sebanyak n kali.
c. Pangkat dari suatu bentuk aljabar $(ax + b)^n$ merupakan hasil dari $(ax)^n + n.ax.b + b^n$.

Figure 4. Students misconceptions in solving problem number 4

The following is an excerpt of the researcher interview (P) with AZM.

P : What was your first step when solving question number 4?
AZM : I multiplied $3x + 7$ with $3x + 7$.
P : Why did you choose that reason at the second level?
AZM : When I multiplied $3x + 7$ with $3x + 7$, I got the answer of $(3x)^2 + 2.3x.7 + 7^2$, so I chose c reason.
P : Are you sure if these reasons are valid? If the power is not 2, does it still follow that pattern?
AZM : I have yet to try. However, it is the same if the power is not two because I tried for power two earlier.

The student can give the correct answer in solving algebraic, exponential operations. When solving $(3x + 7)^2$, the student multiplied $(3x + 7)$ with itself repeatedly according to the number of powers. The student uses the distributive property correctly in describing it, namely by following a pattern $(ax + b)(ax + b) = (ax)^2 + 2.ax.b + b^2$. However, when choosing a reason, the student's error was the power of an algebraic form $(ax + b)^n$ resulted $(ax)^n + n.ax.b + b^n$. This pattern is applied to squares or powers of 2 only. If $n \neq 2$, the pattern will change and cannot be used.

Based on interviews with these students, given that in solving questions, when he had proven $(ax + b)^2 = (ax)^2 + 2.ax.b + b^2$, students concluded that the pattern also applied to all n. Students rush to conclude without trying if n is a number other than two first. Even though the pattern for algebraic exponents varies according to the power. The error in choosing the reason the student made was not following the concept accepted by the experts. This error occurs because students need an adequate understanding of the basic concepts of algebraic exponents, especially regarding patterns and formulas in them, resulting in misconceptions in these students.

Misconceptions about Number 5

In question number 5, students were given problems regarding dividing algebraic forms. Three students needed clarification in solving this problem: UH, DHA, and DKA. For example, in the results of DKA's answer, he chose the wrong answer at the first level, but the reason that was chosen was correct at the second level.

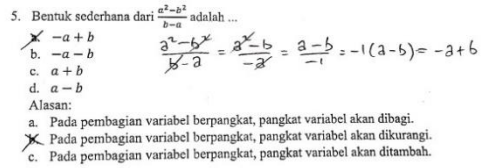

5. Bentuk sederhana dari $\frac{a^2-b^2}{b-a}$ adalah ...
a. $-a+b$
b. $-a-b$
c. $a+b$
d. $a-b$
Alasan:
a. Pada pembagian variabel berpangkat, pangkat variabel akan dibagi.
b. Pada pembagian variabel berpangkat, pangkat variabel akan dikurangi.
c. Pada pembagian variabel berpangkat, pangkat variabel akan ditambah.

Figure 5. Students' misconceptions in solving problem number 5

The following is an excerpt of the researcher interview (P) with DKA.

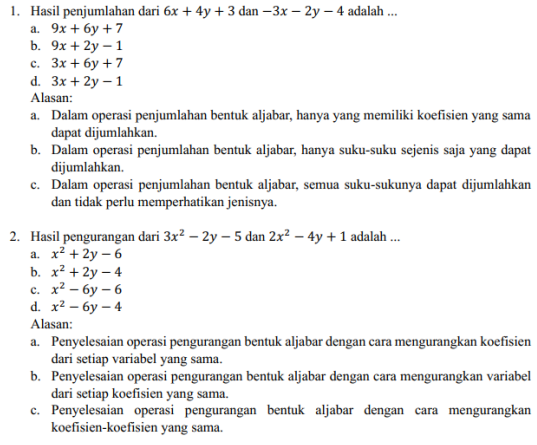
P : What was your first step when solving question number 5?
DKA : There are variables a and b in the numerator and denominator, so I crossed out the same ones.
Q : Are you sure about what you are doing? Why?
DKA : Insya Allah, miss. I once noted the discussion of the problem in my book; for example, $\frac{a\times b^2}{a\times b}$, the same numerator and denominator can be crossed out immediately so that the result is b only. I did it the same as that Miss. I followed the example there.

The student can give good reasons that the step to complete the division of power variables is to subtract the power of the same variable. However, students made errors when solving the questions above by directly dividing or crossing out the same variables without factoring them first. In solving these questions, before carrying out the cross-out system, it must be factored first to get the same value so that it can be crossed out or eliminated. That is because the cross-out system involves multiplication with fractions.

Based on interviews with these students, given that they understand when operating $\frac{a^2-b^2}{b-a}$ can be immediately crossed out as can be done in multiplication, for example, in processing $\frac{a\times b^2}{a\times b}=b$. However, operating $\frac{a^2-b^2}{b-a}$ and $\frac{a\times b^2}{a\times b}$ is a different thing in the process. This caused the final answer obtained by these students to be inaccurate because they were not following the concepts accepted by experts. The errors made by students in solving question number 5 were due to students' lack of adequate understanding of the basic concept of algebraic division, especially in the cross-out system, resulting in misconceptions among these students.

Discussion

This research was conducted at SMP Argopuro Panti for two days, from 22 May 2023 to 23 May 2023, from 07:00 to 08:10 WIB. This discussion focused on quitters students at SMP Argopuro Panti who experienced misconceptions when solving two-tier multiple-choice diagnostic test questions on algebra material. Two-tier multiple-choice diagnostic questions still need to be discovered by the public and even teachers as educators. This test has a function to assess and analyze students understanding of concepts. "Two-tier multiple choice test can be used as an insight into making a form of assessment that challenges students' knowledge, providing a technique to assess students' concepts, especially in classroom learning" (Rintayati et al., 2020). Some examples of questions used in the study can be seen in the figure below.


1. Hasil penjumlahan dari $6x+4y+3$ dan $-3x-2y-4$ adalah ...
a. $9x+6y+7$
b. $9x+2y-1$
c. $3x+6y+7$
d. $3x+2y-1$
Alasan:
a. Dalam operasi penjumlahan bentuk aljabar, hanya yang memiliki koefisien yang sama dapat dijumlahkan.
b. Dalam operasi penjumlahan bentuk aljabar, hanya suku-suku sejenis saja yang dapat dijumlahkan.
c. Dalam operasi penjumlahan bentuk aljabar, semua suku-sukunya dapat dijumlahkan dan tidak perlu memperhatikan jenisnya.

2. Hasil pengurangan dari $3x^2-2y-5$ dan $2x^2-4y+1$ adalah ...
a. x^2+2y-6
b. x^2+2y-4
c. x^2-6y-6
d. x^2-6y-4
Alasan:
a. Penyelesaian operasi pengurangan bentuk aljabar dengan cara mengurangkan koefisien dari setiap variabel yang sama.
b. Penyelesaian operasi pengurangan bentuk aljabar dengan cara mengurangkan variabel dari setiap koefisien yang sama.
c. Penyelesaian operasi pengurangan bentuk aljabar dengan cara mengurangkan koefisien-koefisien yang sama.

Figure 6. Example of two-tier multiple-choice diagnostic questions used in the study.

Two-tier multiple choice diagnostic questions consist of 2 levels. The first level follows the traditional multiple-choice format commonly used to measure student knowledge. Meanwhile, at the second level, the model is like the first level, but the aim is to train students' reasoning abilities. At this second level, multiple choices ask for reasons for students' answers at the first level (Syaifuddin et al., 2022). This is in line with what was said by Andriyanto et al., "The first level (tier I) in the TTMC is a matter of material concepts, while the second level (tier II) is the reason for the answers for level I" (Andriyatno et al., 2023).

. The two-tier diagnostic test differs from the one-tier diagnostic test in the number of questions levels asked and the depth in identifying student misconceptions regarding the material. The two-tier diagnostic test has the advantage of providing more detailed information about students' misconceptions through additional answer choices in the second level. However, two-tier diagnostic tests also have weaknesses. This two-tier test cannot accurately distinguish students who have a correct understanding of the concept, who need help understanding the concept, or who have misconceptions. These tests can provide more detailed information, but interpretation of the results still requires careful consideration.

This study aims to identify the misconceptions of quitters students in solving algebraic problems. "Misconception is students' understanding of a concept that cannot be accepted scientifically" (Anam, 2018). Misconceptions can occur when students try to construct a new understanding based on incorrect or inaccurate previous understanding. "Misconceptions can occur when students are trying to construct knowledge by translating or understanding new experiences in the form of preconception" (Duda et al., 2020).

The results of identifying student misconceptions can assist teachers in designing corrective actions in learning algebra as an effort to overcome misconceptions held by quitters. Teachers can help students improve their understanding of algebraic material by making exemplary efforts. As a result, student learning outcomes in algebra material can increase.

Based on the results of tests using two-tier multiple-choice diagnostic algebra material, interviews, and class observations conducted, several things needed to be corrected by students. In problem number 2 regarding subtraction of algebraic forms, students operated $(3x^2 - 2y - 5) - (2x^2 - 4y + 1)$ only by subtracting the first term, such that it became $3x^2 - 2y - 5 - 2x^2 - 4y + 1$. This misunderstanding aligns with the research results from (Angelo A. Legarde, 2022), which shows one of the results of student answer that multiplies the monomial factor by the first term only.

In question number 3 regarding the multiplication of algebraic forms, students correctly solved using the distributive property. However, students need clarification in operating $-24x - 25x$; the student answered $49x$ instead $-49x$. This is because students understanding and prerequisite skills for algebraic arithmetic operation material must be corrected. This misunderstanding aligns with the research results (Sari & Afriansyah, 2020), which stated that students needed help understanding arithmetic operations, so they could not complete the addition and subtraction of algebraic forms.

In question number 4 regarding algebraic exponents, students needed clarification about the pattern for algebraic exponents. Students assume that there is

an algebraic form $(ax + b)^n$ will always follow the pattern $(ax)^n + n.ax.b + b^n$. This pattern only applies to $n = 2$. If $n \neq 2$, then the pattern will change and not be the same (Ma'rufi & Pasandaran, 2019).

In question number 5 regarding the division of algebraic forms, students needed to understand the cross-out system. Students made errors by directly dividing or crossing out the same variables without factoring them first. This misunderstanding aligns with the research results from (Rahayu et al., 2021), which state that students make understanding errors in simplifying fractional forms in algebra.

Based on the results of the identification of misconceptions carried out on quitters students above, there are several things that teachers as educators can do to be able to overcome these misconceptions, including 1) provide an accurate explanation of the concepts being studied; 2) using learning model that is adapted to the needs of students in order to make it easier for students to understand the concepts being taught correctly, and 3) recall to strengthen students abilities and prerequisite material before learning new material.

Implications

This research identifies misconceptions that occur in students, especially quitters-type students, when learning algebra. By knowing these misconceptions, teachers can specifically develop plans and efforts to overcome them. This research contributes to developing more effective learning strategies to deal with students' misconceptions. With a deep understanding of the misconceptions experienced by these students, teachers can design activities and learning methods that aim to help students improve their understanding.

This research provides valuable insights to teachers regarding misunderstandings or misconceptions that often occur in students so that it can be used as a guide in lesson planning, providing appropriate feedback, and developing more effective learning methods to deal with these misconceptions. In addition, this research could influence the development of better algebra learning materials. Material developers can design more appropriate content by understanding students' misconceptions, including case examples, illustrations, and questions to overcome common misunderstandings or misconceptions.

Limitations

This research is limited to algebraic arithmetic operations, such as addition, subtraction, multiplication, exponential, and algebraic division. Therefore, the results of this study are only limited to misconceptions related to this topic. Other misconceptions not included in this study related to other algebraic concepts may exist.

With a small number of research subjects, the representation of variations in students may need to be appropriately covered. Differences in levels of understanding, socio-economic background, level of intelligence, and other factors that influence misconceptions may need to be adequately reflected in limited subjects. As a result, the generalization of research results is limited to that subject and cannot be applied in general. The results of this study also cannot be immediately generalized to quitters students in other schools or different contexts.

CONCLUSION

This study revealed the misconceptions among quitters students at SMP Argopuro Panti when solving algebraic problems using a two-tier multiple-choice diagnostic test instrument. Based on the results of the study, several misconceptions were found by students, namely: 1) in solving algebraic subtraction questions, students only subtract the first term; 2) students experience misconceptions when operating algebraic forms $-24x - 25x$ answered $49x$; 3) students experience misconceptions about the algebraic, exponential pattern, namely for all n always follow the pattern $(ax + b)^n = (ax)^n + n.ax.b + b^n$; and 4) in operating the division of algebraic forms, students make misunderstanding in using the cross out system. From the description above, this study found the most common misconception among students: students often need to correctly apply the correct rules in solving algebraic arithmetic operations. Efforts that the teacher can make to overcome these misconceptions include providing accurate explanations of the concepts being studied, using learning models adapted to students' needs, and recalling strengthening students' abilities and prerequisite material before learning new material.

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