Analysis of Madrasah Aliyah Students' Errors on Exponent Materials in View of Students' Mathematical Ability Levels

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Abstract

Errors in solving math problems are often found in the steps of answering math problems by students. These errors can have an impact on the final results of students' answers. For this reason, researchers conducted research on the mistakes that are often made by students in answering math problems in terms of students' mathematical ability level. This research used descriptive qualitative research methods. The subjects in this study were class X students at MA Abu Amr Paserpan totaling 29 students. Furthermore, researchers only took 6 students to be interviewed. Data collection in this study was carried out by means of observation, test questions, interviews, and documentation. The results of this study indicate that the types of errors made by students when answering mathematical problems on the material of operating power numbers (exponents) in class X MA Abu Amr Learning Year 2023/2024 consist of three errors, namely, concept errors of 52.29%, language interpretation errors of 48.85% and technical errors of 56.32% where the level of students' mathematical ability also affects the types of errors experienced by these students.

Keywords: Conceptual Error, Language Interpretation Error, Technical Error, Math Proficiency Level, Exponent.

Abstrak

Kesalahan dalam menyelesaikan soal matematika sering kali ditemukan dalam langkah-langkah menjawab soal matematika oleh siswa. Kesalahan-kesalahan tersebut dapat berdampak pada hasil akhir jawaban siswa. Untuk itu, peneliti melakukan penelitian mengenai kesalahan-kesalahan yang sering dilakukan siswa dalam menjawab soal matematika ditinjau dari tingkat kemampuan matematika siswa. Penelitian ini menggunakan metode penelitian kualitatif deskriptif. Subjek dalam penelitian ini adalah siswa kelas X di MA Abu Amr Paserpan yang berjumlah 29 siswa. Selanjutnya peneliti hanya mengambil 6 siswa untuk diwawancarai. Pengumpulan data dalam penelitian ini dilakukan dengan cara observasi, soal tes, wawancara, dan dokumentasi. Hasil penelitian ini menunjukkan bahwa jenis-jenis kesalahan yang dilakukan siswa ketika menjawab soal matematika pada materi operasi bilangan berpangkat (eksponen) di kelas X MA Abu Amr Tahun Pelajaran 2023/2024 terdiri dari tiga kesalahan yaitu, kesalahan konsep sebesar 52,29%, kesalahan interpretasi bahasa sebesar 48,85% dan kesalahan teknis sebesar 56,32% dimana tingkat kemampuan matematika siswa juga mempengaruhi jenis-jenis kesalahan yang dialami siswa tersebut.

Kata kunci: Kesalahan Konsep, Kesalahan Interpretasi Bahasa, Kesalahan Teknis, Tingkat Kemampuan Matematika, Eksponen.

Introduction

Mathematics is one of the branches of science that has an important role in the development of science and technology, both as a tool and in the development of mathematics (Siagian, 2006). Mathematics acts as a foundation of knowledge that supports various other subjects, materials that are relevant to the current era are crucial in determining the success of learning mathematics (Anggraini, 2022). In addition, mathematics is not only needed in the academic field, but also plays an important

role in everyday life to ensure the success and progress of human life.

Mathematics is a branch of a deep and wide-ranging science (Vieire et al, 2023). One of the materials in mathematics is the operation of signed numbers (exponents). Mathematics is not only considered the foundation of all sciences, but also a fundamental subject from the elementary level to the college level. However, the main challenge in teaching mathematics lies in the learning process. If the learning approach is not effective, students' mathematical understanding can be hampered. This is due to the dominance of the expository method, where teachers provide more verbal explanations and example problems, while students become passive.

Hopefully, every student has adequate mathematical skills to facilitate the learning process (Hartono, 2020). These abilities are not only important for education, but also play a key role in the progress and development of science, technology and innovation. Therefore, the application of mathematical concepts and the development of mathematical abilities, including aspects of communication, representation, and reasoning, are very important. Mathematical skills are also key in solving various challenges in everyday life that can minimize student errors.

An error is a form of mistake, oversight, or anything that is wrong, as well as something that is not in accordance with existing procedures or rules that have systematic, consistent, and incidental properties (Pramesti & Rini, 2020). In learning mathematics there are several errors that may occur. According to Pramesti & Rini (2020), There are 5 types of errors mainly (1) concept errors. The indicators of errors that occur in determining the theorem or formula when answering a problem or problem. Students use theorems or formulas that are not in accordance with the prerequisite conditions for the validity of the formula or even do not write the theorem. (2) Error using data, this indicators include, students do not use the correct data or what should be used and errors in entering data into variables. As well as adding data that is not even needed in answering a problem or problem. (3). language interpretation errors, this indicators include, errors in expressing or conveying everyday language in mathematical language. Error interpreting various forms of symbols on graphs, and tables into mathematical language. (4). Technical Errors, this indicators include, errors in calculation or computation activities. And Errors in manipulating algebraic number operations. (5). Errors in inference or conclusions, this indicators include, making inferences without any correct and appropriate supporting reasons. Inferring statements from the results of calculations that are less or not in accordance with logical reasoning.

These errors can affect the final results of students in working on exam and test questions. So that many students find it difficult to solve math problems. Even though the value is obtained because of confusion or errors in the process. Therefore, students must be able to minimize errors in solving problems so that students can get better grades. Students must also be able to understand the questions asked and also understand the material. Given that this exponent number material can still be considered quite easy. In learning mathematics there are basic abilities that students have. Basic mathematical ability is a basic form of ability able to think deductively in the use of theory and communicate the results of scientific activities (learning) correctly and be able to communicate exact, careful artifical language in mathematics.

Based on the results of observations that have been made at MA Abu Amr, several facts are obtained regarding the value of student exam results. Where some students who get low scores experience many mistakes in answering or solving existing problems and vice versa students who get high scores only experience a few mistakes in answering questions. This is in accordance with the opinion of Pramesti and Rini (2020), that students with low scores experience many mistakes in answering questions and solving problems. While students with high scores experience few errors in answering questions and solving problems.

According to Abdullah et al, (2015) shows that students often make mistakes in coding (27.58%), followed by process skill errors (27.33%), transformation (24.17%) and understanding (20.92%). Rahma et al, (2022) also showed that the errors made by students in solving exponent problems were (1) reading errors; (2) errors in understanding the problem; (3) problem transformation errors; (4) process skills errors; (5) errors in writing answers. The factors that cause errors found are students lack of understanding the concept of exponents, lack of understanding the conditions for using exponent properties, difficulty dealing with problems in the form of story problems, difficulty determining formulas, students rarely prepare learning materials in class, do not repeat the material obtained, lack of practice problems, easily bored if they do not understand the material, and are reluctant to ask when

they find difficulties. Furthermore, Sukmana et al (2019) shows that the errors made by students in solving problems of ranked numbers and root forms: (1) errors in understanding the meaning of the problem; (2) errors in understanding and applying concepts; and (3) errors in calculating. The factors that cause students to make mistakes are that students do not understand the meaning of the question asked, students have not mastered the prerequisite material such as: exponent numbers, students do not understand the material, students forget the formula, students lack practice in solving problems about power numbers and root forms, students are less careful in calculating, students do not check the answers that have been done.

Based on Sukmana et al (2019) shows the type of concept error from the auditory learning style subject is unable to restate concepts in mathematical representations which results in the subject having difficulties and errors in using problem solving algorithms that result in incorrect subject work. The type of subject concept error is that the subject is unable to restate the concept of the problem in mathematical representation, the subject is unable to group similar terms. The type of concept error from subjects with kinesthetic learning styles is wrong in using the problem solving algorithm, the subject is unable to find the final solution because he does not understand the concept in the previous material (Ridho'i et al, 2023).

Based on this explanation, it is necessary to analyze student errors. The aim of this study is to analysis of MA students' errors on exponent material in view of students' mathematical ability level. This research formulates how the forms of errors in answering math problems that are being experienced by students on the material of the operation of power numbers (exponents) based on high, medium, and low levels of mathematical ability. This research is intended to describe the various forms of errors in answering math problems experienced by students in the material of operating power numbers.

Method

In this study, researchers used descriptive qualitative research methods. Qualitative descriptive research is a research method based on the philosophy of postpositivism which is used to research on natural object conditions where the researcher is the key instrument, data collection techniques are triangulated or combined, data analysis is inductive or qualitative, and research results emphasize meaning over generalization (Sugiyono, 2016).

The following are the stages in conducting research, namely, first the researcher designs the research, then the researcher makes test questions and interviews, then the researcher carries out research actions with test questions and interviews, after which the researcher assesses the results of the subject's answers and then analyzes the data so that the researcher can draw conclusions. In this study, researchers conducted research in class 10 MA Abu Amr which consisted of 29 students. They were given questions then the researcher only took 6 students as research subjects to be interviewed with the criteria of 2 students with high math ability levels, 2 students with moderate math ability and 2 other students with low math ability. Then, researchers can determine the subject from the results of students' math test scores.

Data collection in this study used tests and interviews. Tests in the form of diagnostic questions consisted of 5 description questions with the material of the operation of power numbers (exponents). Interviews were used to dig deeper information related to errors experienced by students by analyzing the answers to test questions that have been given after the diagnostic test is given. Interviews were conducted with 6 research subjects who were selected with criteria according to the level of mathematical ability.

Result and Discussion

In this study, researchers took 3 indicators of errors, namely concept errors, language interpretation errors, and technical errors. Interviews conducted during the research were taken 6 students as research subjects. The selection of subjects was carried out based on the number of errors

made by students when solving the problem of operating on power numbers. The following is the result of the research, obtained the percentage of errors made by students.

Table 1. Percentage of Student Error Types

Indicator/Question	Concept Error	Language Interpretation Error	Technical Errors
1a	11	12	18
1b	13	15	16
2	17	11	13
3	19	16	15
4	15	17	17
5	16	14	19
	91 (52,29%)	85 (48,85%)	98 (56,32%)

Based on table 1, it is obtained that of the 29 students who worked on the problem, there were several students who made mistakes in working on the problem where students who made conceptual errors were 52.29%, students who made language interpretation errors were 48.85%, and students who made technical errors were 56.32%. Therefore, seeing from the test results of 29 students in class X Madrasah Aliyah Abu Amr Paserpan in the 2023/2024 academic year, the researcher conducted interviews with 6 students with the criteria of 2 high ability students, 2 medium ability students and 2 low ability students so that data can be obtained about the mistakes made by students in solving the problem of operating power numbers.

The following are the answers and interview results of 6 subjects

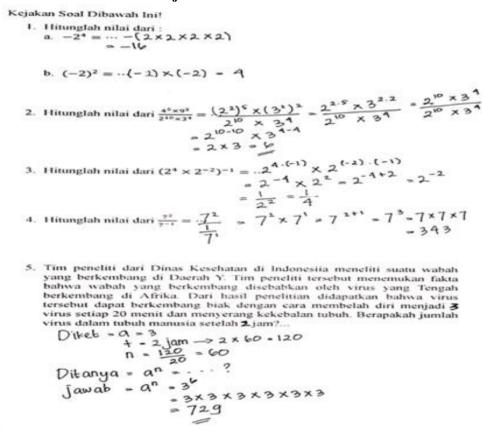**Answers and interview results of subject 1**

Figure 2. Subject 1's answer

Subject 1 interview:

P : "Are you sure about your answer?".

S1 : "I am sure for questions number 1a, 1b, 3, 4, and 5. but for question number 2 I am not sure".

P : "What makes you unsure of your answer?"

S1 : "I'm confused and it seems I'm also wrong in calculating it".

P : "What made you confused? And how did you do it?".

S1 : "The final result actually has a power of zero, but I don't know the value. I did it directly multiplied for the final result."

From the results of the work of subject 1 in question No.2 it can be seen that the Subject does not understand the value of a zero power number. In this case the subject already knows what a power number is, therefore the subject can operate power numbers. However, the subject made technical and conceptual errors by operating the wrong numbers. Subject 1 still does not understand the result or value of a power of zero, this is the reason why the subject cannot solve or answer the problem into the right and correct answer.

Based on the results of the analysis of the work of subject 1 in question No. 2, it can be seen that the subject experienced technical and conceptual errors where the subject was wrong in calculating the power of zero. The factors that caused subject 1 to make these mistakes. To find out the causal factors that influence subject 1 to make mistakes can be obtained from the results of the interview with subject 1. From the results of the interview with subject 1, it can be seen that the subject cannot understand the value of a power of zero. Subject 1's incomprehension occurred because he did not understand the abstract material, was still confused about the results or values of numbers with a power of zero, lack of understanding of the material of numbers with a power of zero and lack of practice of other varied problems.

Forms of Errors of High Mathematics Ability Students (S1)

Based on the results of the misconception analysis on the answers to the test questions, S1 experienced 2 types of errors, namely concept errors and technical errors. According to Pramesti and Rini (2020), concept errors are errors that occur in determining theorems or formulas when answering questions while technical errors are errors in calculation or computation. This subject knows and performs the steps in working on the given problem correctly, but the subject makes mistakes in calculating. S1 can solve problems number 1a, 1b, 3, 4, and 5 with the correct steps and according to the rules, it's just that S1 is not careful in calculating the results of problem number 2.

Answers and interview results of subject 2

Subject 2 interview

P : "Are you sure about your answer?".

S2 : "I am sure for questions number 1a, 1b, 3, and 4. but for questions number 2 and 5 I am not sure".

P : "What makes you unsure of your answer?"

S2 : "I'm confused and it seems I'm also wrong in calculating it".

P : "What made you confused? And how did you do it?".

S2 : "In problem number 2 I think I calculated it wrong. The way I solve it is directly I multiply it, for the power number I multiply it by the power."

Figure 3. Subject 2's answer

From the results of subject 2's work on questions No.2 and 5, it can be seen that the Subject does not understand the concept of power numbers. In this case the subject still does not understand what a power number is, therefore the subject cannot operate a power number. This is what makes the subject make technical and conceptual errors by operating the wrong numbers. Subject 2 still does not understand how to calculate or determine the value of a power number, this is the reason why the subject cannot solve or answer the problem into the right and correct answer.

Based on the results of the analysis of subject 2's work on questions No. 2 and 5, it can be seen that the subject experienced technical and conceptual errors where the subject was wrong in operating or calculating power numbers. The factors that caused subject 2 to make these mistakes. To find out the causal factors that influence subject 2 to make mistakes can be obtained from the results of the interview with subject 2. From the results of the interview with subject 2, it can be seen that the subject cannot operate or calculate power numbers. Subject 2's incomprehension occurred because he did not understand the abstract material, was still confused about how to calculate or operate power numbers, lack of understanding of power number operation material and lack of practice of other varied problems.

Forms of Errors of High Mathematics Ability Students (S2)

Based on the results of the analysis of student errors in the answers to the test questions done by S2, it was found that S2 experienced 2 types of errors, namely concept errors and technical errors.

According to Pramesti and Rini (2020), concept errors are errors that occur in determining theorems or formulas when answering questions. While technical errors are errors in calculation or computation. Where the subject knows and performs the steps in working on the given problem correctly, but the subject makes mistakes in calculating. S2 can solve problems number 1a, 1b, 3, and 4 according to the steps of working well and correctly according to the rules. It's just that the subject makes mistakes and is less careful in completing the answers to questions number 2 and 5. The subject is wrong in determining and calculating the results of a power number where the subject multiplies the power number by the power as the answer.

Answers and interview results of subject 3

Figure 4. Subject 3's answer

Subject 3 interview:

P : "Are you sure about your answer?".

S3 : "I am sure for questions number 1a, 1b, 3, and 4. but for questions number 2, 3, 4, and 5 I am not sure".

P : "What makes you unsure of your answer?"

S3 : "I'm confused and it seems I'm also wrong in calculating it".

P : "What makes you confused? How did you do it?".

S3 : "I can't calculate power numbers. I was also careless in answering the question. Because I really don't understand how to answer it. I answer these questions by multiplying only."

From the results of subject 3's work on questions No.2, 3, 4, and 5, it can be seen that the subject does not understand the concept of power numbers. In this case the subject still does not understand what a power number is and how to operate a power number, therefore the subject cannot solve several problems of power number material. This is what makes the subject make technical and conceptual errors by operating the wrong numbers. Subject 3 still does not understand how to calculate or determine the value of a power number, this is the reason why the subject cannot solve or answer the problem into the right and correct answer. Based on the results of the analysis of subject 2's work on question numbers. Based on problem No. 2, 3, 4, and 5, it can be seen that the subject experienced technical and conceptual errors where the subject was wrong in operating or calculating power numbers. The factors that caused subject 3 to make these mistakes. To find out the causal factors that influence subject 3 to make mistakes can be obtained from the results of interviews with subject 3.

From the results of the interview with subject 3 it can be seen that the subject cannot operate or calculate power numbers. Subject 3's incomprehension occurred because he did not understand the abstract material, was still confused about how to calculate or operate power numbers and lack of understanding of power number operation material.

Forms of Error of Students with low mathematics ability (S3)

Based on the results of the analysis of errors in the answers to the test questions done, S3 experienced 2 types of errors, namely concept errors and technical errors. According to Pramesti and Rini (2020), concept errors are errors that occur in determining the theorem or formula when answering questions. While technical errors are errors in calculation or computation. Where the subject lacks understanding and cannot perform the steps in working on the given problem properly and correctly, the subject also makes mistakes in calculating and understanding the problem. S3 can solve problems number 1a and 1b in accordance with the steps of working well and correctly according to the rules. However, the subject also made mistakes and was less careful in completing the answers to questions number 2, 3, 4, and 5. The subject is wrong in determining and calculating the results of a power number where the subject multiplies the power number by its power as the answer.

Answers and interview results of subject 4

Subject 4 interview:

    P : "Are you sure about your answer?".

    S4 : "I am sure for questions number 1a, 1b, and 3. but for questions number 2, 4, and 5 I am not sure".

    P : "What makes you unsure of your answer?"

    S4 : "I'm confused and it seems I'm also wrong in calculating it, I also don't understand the meaning of question number 5".

    P : "What makes you confused? How did you do it?".

    S4 : "I can't calculate power numbers. I was also careless in answering the question. Because I really don't understand how to answer it. I answer these questions by multiplying. The problem is in the form of a story. I don't understand what to look for if the question is in the form of a story like number 5. So I didn't answer it".

Figure 5. Subject 4's answer

From the results of subject 4's work on question numbers No. 2, 4, and 5 it can be seen that the Subject does not understand the concept of power numbers. In this case the subject still does not understand what a power number is and how to operate a power number, therefore the subject cannot solve several problems of power number material. This is what makes the subject make technical and conceptual errors by operating the wrong numbers. Subject 4 still does not understand how to calculate or determine the value of a power number, this is the reason why the subject cannot solve or answer the problem into the right and correct answer. Based on the results of the analysis of subject 2's work on question numbers No. 2, 4, and 5, it can be seen that the subject experiences technical errors, conceptual errors, and language interpretation errors where the subject is wrong in operating or calculating power numbers and the subject cannot understand the meaning of the story problem in number 5. So that the subject does not work on problem number 5 this is because the subject cannot understand the language in the problem. The factors that caused subject 4 to make these mistakes. The causal factors that influence subject 4 for making mistake can be obtained by interviewing subject 4.

From the results of the interview with subject 4, it can be seen that the subject cannot operate or calculate power numbers and the subject cannot understand the meaning of the story problem. Subject 4's incomprehension occurred because he did not understand the abstract material, was still confused about how to calculate or operate power numbers, lack of understanding of the interpretation of the language in the problem, lack of understanding of the material on the operation of power numbers, lack of love for learning mathematics so as to reduce understanding of mathematical material and lack of practice of other varied problems.

Forms of Error of Students with moderate mathematics ability (S4)

Based on the results of the error analysis on the answers to the test questions, S4 experienced 3 types of errors, namely concept errors, interpretation errors, and technical errors. According to Pramesti and Rini (2020), concept errors are errors that occur in determining theorems or formulas when answering questions. Language interpretation errors are errors in expressing or conveying language in mathematics while technical errors are errors in calculation or computation. The subject knows and performs the steps in working on the given problem correctly, but the subject makes mistakes in calculating and understanding the problem. S4 can solve problems number 1a, 1b, and 3 according to the steps of working well and correctly according to the rules. It's just that the subject made mistakes and was less careful in completing the answers to questions number 2 and 4. In addition, S4 could not answer question number 5, this was because S4 did not understand the meaning of the story problem. The subject is wrong in determining and calculating the result of a power number where the subject multiplies the power number by the power as the answer. The subject also did not solve or answer problem number 5.

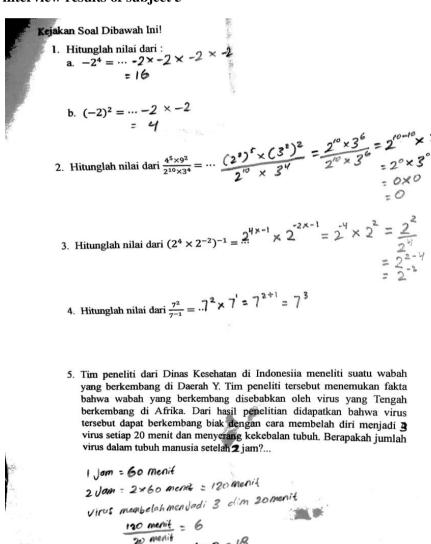**Answers and interview results of subject 5**

Figure 6. Subject 5's answer

P   : "Are you sure about this answer?".
S5 : "I'm not sure sis. The problem is I can't do math.
P   :" Look at numbers 1a and 1b.
Is the result going to be the same positive?"
S5 :" I think so, sis. It's a negative number that is raised and the power is an even number.
So if multiplied, it must be positive."
P   : "Try to pay attention again. Isn't there something different about the two problems?"
S5 : "oh yes, sis. 1a has no brackets. While 1b has brackets."
P   : "Yes, that's right. Now look at number 2, are you sure the final result is 0?"
S5   : "Yes, sis, the problem is the power of 0 so all numbers when multiplied by 0 the result
is 0".
P   : "Are you sure like that, isn't that the concept of multiplication?"
S5   :" oh yes sis I think it's the same."
P   : "Now look at number 5. Are you sure it's correct?"
S5 : "yes sis. The virus divides into 3 every 20 minutes. Now the time will be 2 hours. So
I changed it to 120 minutes first. Then divide it by 20 and multiply the result by 3."
P   : "Why multiplied deck? Shouldn't it be raised!"
S5 : "oh yes, sis. I thought it was just multiplied."

Based on the picture of S5's answer, S5 made mistakes in numbers 1, 2 and 5. Where in number 1, the subject experienced a concept error where when the subject was faced with a negative number with a power, the method of work was the same as a positive number with a power, only with a negative. In number 2, the subject experienced a concept error where the subject thought that any number that was multiplied by zero, the result was zero. Whereas in number 5, the subject experienced language interpretation errors and conceptual errors. Where when faced with a story problem, the subject thought it was multiplied not raised.

Forms of Error of Students with Moderate Mathematical Ability (S5)

Based on the results of the error analysis on the answers to the test questions, S4 experienced 2 types of errors, namely concept errors and interpretation errors. According to Pramesti and Rini (2020), concept errors are errors that occur in determining theorems or formulas when answering questions. While language interpretation errors are errors in expressing or conveying language in mathematics. Where the subject knows and performs the steps in working on the given problem correctly, but the subject makes mistakes in calculating and understanding the problem.

Answers and interview results of subject 6
P : "Are you sure about your answer?".
S6: "I'm sure or not sure, just make sure. I don't like math so I'm not in the mood if you ask me to do math problems".
P : "What makes you not like math?"
S6 :" It's the calculations that ruin my mood. I also rarely pay attention to the teacher when teaching."
P : "Then you can do 6 problems. Do it all again."
S6 :" Yes, sis. But I did the math carelessly".

P : "Umm... let's see the answer to number 1a. The final result is correct. It's just the way to reach the result that has to be slightly corrected. This means that you can do math.

S6 : "That's the only time I did it, sis. The cladding is multiplied by the number itself as much as the power. I was a bit confused because there is a min. But because the power doesn't have min, I thought only the first number should be marked with min, the others don't need it."

P: "Yes, that's right. But it's actually the number first multiplied by the power. Then min is given."

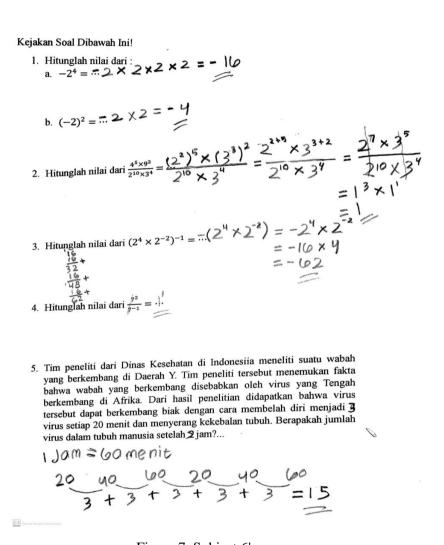S6 :" oh, that's how it turned out. Yes, I understand now."

Figure 7. Subject 6's answer

Based on the picture of the answer and the results of the interview with S6, S6 made mistakes in all numbers. In number 1, the subject experienced a concept error where the subject did not understand when faced with a multiplication operation that had a negative. In No. 2, the subject experienced conceptual errors and technical errors, where the subject did not know the concept of a power number if it was raised again, the operation was the first power in the parenthesis multiplied by the second power outside the parenthesis. In addition, the subject also lacks understanding of the concept when there are the same numbers in the division operation even though they are different ranks, the subject immediately crosses them out. And the subject miscalculated, where the subject thought 3 times 3 was 3 to the power of 3. In number 3, the subject experienced a concept error where the subject was confused when faced with multiplication in parentheses then there was a negative power outside the parentheses.

In number 4, the subject experienced a concept error where the subject immediately crossed out the same number in the division operation without seeing whether the rank was the same or not. In number 5, the subject experienced conceptual errors and language interpretation errors. Where the subject failed to understand and describe the meaning of problem number 5. Furthermore, the subject took the wrong concept in answering it which automatically made mistakes in the technical work too.

Forms of Error for Students with Low Mathematical Ability (S6)

Based on the results of the error analysis on the answers to the test questions, S4 experienced 3 types of errors, namely concept errors, interpretation errors, and technical errors. According to Rohmah et al (2023) that concept errors are errors that occur in determining theorems or formulas when answering questions. Language interpretation errors are errors in expressing or conveying language in mathematics while technical errors are errors in calculation or computation. The subject knows and performs the steps in working on the given problem correctly, but the subject makes mistakes in calculating and understanding the problem. In addition, the subject also seemed not to care about the results of his answers. So it is possible that the subject also lacks motivation to learn. The subject is also less careful in answering the question and does not understand what is asked in the question.

Conclusion

Based on the description and analysis of data on errors of students in class X MA Abu Amr Tambakrejo Pasrepan, the conclusion is that students experience concept errors as much as 52.29%, language interpretation errors as much as 48.85%, and technical errors as much as 56.29% with details of the types of errors of high ability students S1 & S2 namely S1 and S2 experiencing concept errors and technical errors. The types of errors experienced by low math ability students, namely S4 and S5, namely S4 experienced concept errors, technical errors and language interpretation errors, while S5 experienced concept errors and language interpretation errors. The types of errors experienced by low mathematics ability students S3 and S6, namely S3 experienced concept errors and technical errors, while S6 experienced concept errors, technical errors and language interpretation errors.

References

Abdullah, A. H., Abidin, N. L., & Ali, M. (2015). Analysis of Students' Errors in Solving Higher Order Thinking (HOTS) Problems for the Topic of Fraction. *Asian Social Science*, 11(21), 133.

Anggraini, L. (2022). *Pembelajaran Kuantum dalam Matematika*. Indonesia: Guepedia.

Hartono, S. (2020). Effectiveness of Geometer's sketchpad learning in two-dimensional shapes. *Editorial from Bronisław Czarnocha*, 84.

Hendricks, cher. (2009). *Improving school through action research: A comprehensive Guide for Educators. Uper Saddle River*, New Jersey: Pearson Education.

Pramesti, S.L.D. & Rini, J. (2020). *Pembelajaran Matematika Sekolah*. Indonesia: Penerbit NEM.

Rahma, A.F. & Khabibah, S. (2022). Analisis Kesalahan Siswa SMA Dalam Menyelesaikan Soal Eksponen. *MATHEdunesa: Jurnal Ilmiah Pendidikan Matematika*, 11(2), 446-457.

Ridho'i, M. & Agustin, D.R. 2023. Analisis Kesalahan Konsep Siswa SMK Dalam Menyelesaikan Soal Eksponen Ditinjau Dari Gaya Belajar. *JPIn: Jurnal Pendidikan Indonesia*, 05(02), 1-12.

Rohmah, S., Jannah, I., & Qowiyuddin, A. (2023). Analysis Of Madrasah Aliyah Students' Errors On Exponent Materials Given Students' Mathematical Ability Levels. *Jurnal Multidisiplin Indonesia*, 1(4), 206-225.

Santi, L.M. & Sudihartinih, E. (2019). Analisis Kesalahan Siswa Sekolah Menengah Pertama Pada Materi Pecahan. *Jurnal Pendidikan*, 4(2), 1-5.

Siagian, S. P. (2006). *Sistem Informasi Manajemen*. Jakarta: Bumi Aksara.

Sugiyono. (2016). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: CV Alfabeta.

Ulusoy, F. (2019). Serious obstacles hindering middle school students' understanding of integer exponents. *International Journal of Research in Education and Science (IJRES),* 5(1), 52-69.

Vieira, L. C., Costa, R. S., & Valério, D. (2023). An Overview of Mathematical Modelling in Cancer Research: Fractional Calculus as Modelling Tool. *Fractal and Fractional*, 7(8), 595.