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Analysis of Errors of Grade VIII Students in Solving Minimum Competency Assessment (AKM) Questions Based on *Newman's Theory*

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Abstrak

Penelitian ini bertujuan untuk mengetahui kesalahan yang dilakukan siswa kelas VIII SMP Negeri Fatumfaun terletak di kabupaten Timor Tengah Utara dalam menyelesaikan soal AKM berdasarkan teori *Newman*. Jenis penelitian ini adalah penelitian deskripsi kualitatif, yang dilakukan pada siswa kelas VIII A SMP Negeri Fatumfaun yang berjumlah 23 siswa. Teknik pengumpulan data dalam penelitian ini menggunakan tes tertulis, wawancara, dan dokumentasi. Instrumen tes terdiri dari 3 butir soal AKM Numerasi yang telah di validasi. Teknik analisis data digunakan dalam penelitian ini adalah reduksi data, penyajian data, dan penarikan kesimpulan. Jenis kesalahan siswa dilakukan oleh siswa dalam menyelesaikan soal AKM berdasarkan teori *newman* yaitu kesalahan memahami yakni siswa tidak dapat memahami soal sehingga salah dalam menentukkan apa yang ditanyakan dalam soal. Kesalahan transformasi yakni siswa tidak mampu mengubah informasi yang diminta menjadi model matematika, tidak mengingat rumus yang digunakan dan tidak mampu mensubstitusikan informasi yang diberikan ke dalam rumus yang digunakan. Kesalahan proses yakni siswa melakukan kesalahan dalam operasi dasar matematika seperti penjumlahan, pengurangan, dan perkalian. Kesalahan penulisan jawaban akhir yakni siswa tidak mampu menuliskan kesimpulan dari hasil pengerjaan yang telah dilakukan dan melakukan kesalahan penulisan pada jawaban akhir.

Abstract

This study aims to determine the errors made by students of class VIII of SMP Negeri Fatumfaun located in North Central Timor Regency in solving AKM questions based on Newman's theory. This type of research is qualitative descriptive research, which was conducted on 23 students of class VIII A of SMP Negeri Fatumfaun . The data collection technique in this study used written tests, interviews, and documentation. The test instrument consisted of 3 validated AKM Numeracy questions. The data analysis techniques used in this study were data reduction, data presentation, and drawing conclusions. The types of student errors made by students in solving AKM questions based on Newman's theory are errors in understanding, namely students cannot understand the questions so that they are wrong in determining what is asked in the questions. Transformation errors, namely students are unable to change the requested information into a mathematical model, do not remember the formula used and are unable to substitute the information given into the formula used. Process errors, namely students make mistakes in basic mathematical operations such as addition, subtraction, and multiplication. Errors in writing the final answer, namely students are unable to write conclusions from the results of the work that has been done and make errors in writing the final answer.

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Introduction

Assessment Minimum Competency (AKM) is initiative government designed as preparation beginning For prepare student face future demands (Andiani dkk., 2020). Minimum Competency Assessment (AKM) is an assessment process that aims to determine the minimum level of ability or knowledge required to achieve a certain standard in a field or profession. In AKM, there are two basic competencies , namely reading literacy and mathematical literacy (numeracy). One of the basic abilities of AKM is numeracy ability. According to Alamsyah & Samanhudi (2022)numeracy ability, it is intended as a person's ability that aims to interpret mathematics in many ways including expertise in reasoning theoretically and using concepts as a medium to explain real events. In simple terms, numeracy ability is the ability to use, understand and analyze mathematics in different contexts to solve different problems in everyday life.

In solving AKM questions, especially AKM questions about numeracy, students tend to experience difficulties. According to Akhidayati dkk. (2024)students' difficulties in solving AKM numeracy questions, namely, in the process of formulating, the process of applying, and the process of interpreting. Departing from the difficulties experienced by students, it shows that in solving AKM questions students tend to make mistakes in solving AKM questions. While numeracy questions require students to have the ability to think using concepts, procedures, facts, and mathematical tools. The goal is to gain an understanding of basic calculations, with the hope of then being able to solve everyday problems. In other words, these questions are related to students' daily lives or situations that they can imagine (Güler & Arslan, 2019). One of the types of AKM questions is mostly complex story questions with various types of questions that make students have difficulty in solving these questions. According to Jupri & Drijvers (2016), students face difficulties in solving math story problems because of three main factors: understanding the problem, formulating a mathematical model or equation, and showing the steps to solve it.

Based on observations made at SMP Negeri Fatumfaun, many students have difficulty in working on story problems, one of which is on the Cartesian coordinate material, because students' ability to use various numbers or symbols related to basic mathematics in solving everyday life problems is still lacking. This can be seen from the 2024 SMP Negeri Fatumfaun Education Report data where, students' numeracy skills based on the 2024 AKM results, there were 48.89% of students who achieved minimum competency. The proportion of students with numeracy skills above the minimum competency was only 8.89%, the proportion of students with numeracy skills reached 40.00%, the proportion of students with numeracy skills below the minimum competency was 31.11% and the proportion of students who had numeracy skills far below the minimum competency was 20.00%. It can be concluded that 51.11% of students at SMP Negeri Fatumfaun have not achieved minimum competency . The low basic numeracy skills of SMP Negeri Fatumfaun students in solving story problems can cause students to have difficulty when working on AKM questions. The

difficulties faced by students in completing AKM questions can cause students to make mistakes in working on these questions. Errors can occur at various stages, such as in understanding, planning, carrying out the process, or writing the final answer (Wijaya & Masriyah, 2013).

Based on the description, an analysis is needed to identify the various types of errors that often occur in students when answering AKM numeracy type questions. There are several theories for analyzing student errors, one of which is *Newman's Error Analysis (NEA*) or better known as *Newman's theory* . According to Prakitipong & Nakamura, (2006), the *Newman procedure* is a method for analyzing errors made by students when completing AKM (Minimum Competency Assessment) questions. This aims to help students understand and solve AKM mathematics questions well through understanding the mistakes they make.

Based on the research results Ilmiyah dkk, (2018), it shows that a number of students make mistakes in solving descriptive questions, with these mistakes being categorized based on the stages in *Newman's theory* . These mistakes mainly occur at the stages of reading the problem , understanding the problem, process skills , and problem transformation. This is in line with the results of the study (Agustina dkk., 2022). Student errors are reviewed from Newman's error analysis procedure as follows; a) Reading Errors , b) Understanding Errors, c) Transformation Errors, d) Process Skills Errors, e) Final Answer Writing Errors. In addition (Aprilianti et al., 2024) the results of his research showed that the errors the biggest thing done by students that is type error transformation that is with percentage by 55%. Students more Lots do error in determine the formula that will used in finish question . Error the due to Because student use wrong formula in finish question , less understand material prerequisites , less thorough , and too in a hurry in finish question . Based on the description above, this study also examines the types of student errors, but what is different is that the researcher wants to analyze if the questions given are AKM questions, as the purpose of the study is to analyze the types of errors made by students in completing descriptive questions on the Minimum Competency Assessment (AKM). Therefore, a comprehensive analysis is needed to understand and overcome these errors, so that learning can be more effective and support student competency achievement.

Method

The research method used is qualitative descriptive research. This research was conducted in class VIIIA of SMP Negeri Fatumfaun, totaling 23 students in the odd semester of the 2024/2025 academic year. The subjects of this study were taken using a *purposive sampling technique* , and 3 students were selected who made many mistakes in working on the test questions to be interviewed. The instruments used in this study were test questions, interview guidelines and documentation. The data collection techniques used in this study were giving tests, interviews and documentation. The data analysis technique was data reduction , data presentation (*display*), and drawing conclusions . The following are indicators of student errors referring to *Newman's* steps .

Table 1Theory Indicators

No	Error Stage	Indicator
1.	*Reading* Error	a. Students are less precise in explaining terms that are difficult to spell. b. Student No capable catch existing information in question after read question
2.	Error Understand *(Comprehension)*	a. Students are unable to write down what they know and explain it implicitly. b. Students are not yet able to write down what is being asked and explain the meaning of the question. c. Without any explanation, students write their own symbols. d. Students write the requested context briefly and also unclearly. e. Students write the requested context but it does not match the content of the question.
3.	Error Transformation *(Transformation Error)*	a. Students are not yet able to change the information in the problem into mathematical sentences and explain the process. b. Students change the information in the problem into an incorrect mathematical sentence.
4.	Error Process Skill *Error*	a. Error student when do calculation b. Student do error moment explains the calculation process contained in the sheet answer c. Student No complete the work process
5.	Error Writing Final Answer (*Encoding Error)*	a. Student No write the answer b. Students are wrong in write answer end c. Written answers student No with context question d. Student use unit that is not in accordance

To find out the percentage of student errors, the average formula is used with add up all mark individual and then share it with total amount of data available (Rahmawati, 2021):

$$p_1 = \frac{x_1}{\sum x} \times 100\%$$

Information:

p_1 = Percentage of student errors in type i

x_1= Number of incorrect answers experienced by student i

$\sum x$= Number of possible errors that may occur

Results and Discussion

Research result

In this research activity, two types of data were used, namely student work results data (tests) and interview results. The questions used in test is question descriptive validated by the validator with a total of 3 questions . When students has answer questions , researchers check and analyze the answer . The answer result student classified according to levels *Newman* namely : error read *(Reading Error)* , error understand *(Comprehension)* , error transformation *(Transformation Error)* , process error *(Process Skill Error)* , and error writing answer end (*Encoding Error)* . Then 3 students were selected to do Lots error as subject interview . The following table is the result of calculating the percentage of errors made by students.

Table 2. Percentage Error Student

No. Question	Error Type				
	Read	**Understand**	**Transformation**	**Process**	**Final Answer**
1	0	11	10	10	13
2	0	12	16	20	18
3	0	14	19	19	19
Amount	**0**	**37**	**45**	**49**	**50**
Percentage	**0**	**53, 62%**	**65.21%**	**71.01%**	**72.46%**

Based on the test results on 23 students of class VIII A of SMP Negeri Fatumfaun, it shows that students made mistakes based on Newman's theory, namely 53.62% of students made mistakes in understanding questions, 65.21% of students made mistakes in transforming questions, 71.01% of students made mistakes in process skills, and 72.46% of students made mistakes in writing the final answer. The following are the results of the work and interviews with 3 students.

a. Description of SI Students in completing AKM questions

The following are the answers from S1 student number 1:

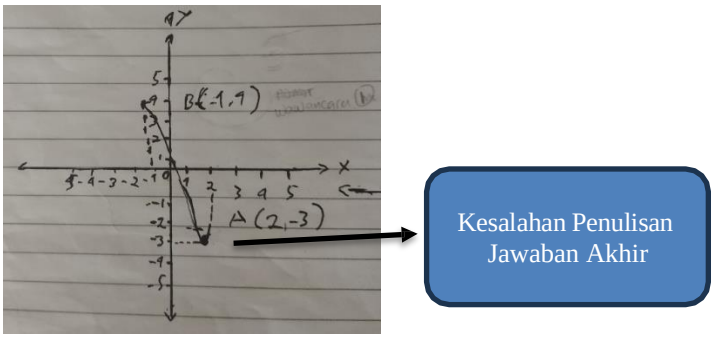

Figure 1. Errors of undergraduate students on question number 1

Based on the tests and interviews conducted by researchers to S1, it can be seen from question number 1, that S1 is able to understand the question, this can be seen from the student being able to know what is known and asked in the question, S1 is also able to understand the Cartesian coordinate points of the x and y axes correctly. S1 is also able to transform the known points A and B into the Cartesian coordinate image correctly, this can be seen in the results of the S1 test in the form of a Cartesian coordinate image. S1 is also able to solve the question with the right process, but student S1 made a mistake in writing the final answer, where student S1 did not write the final conclusion of the two points. When the interview was conducted, student S1 did not write the conclusion because he did not know how to conclude it.

The following are the answers from S1 student number 2:

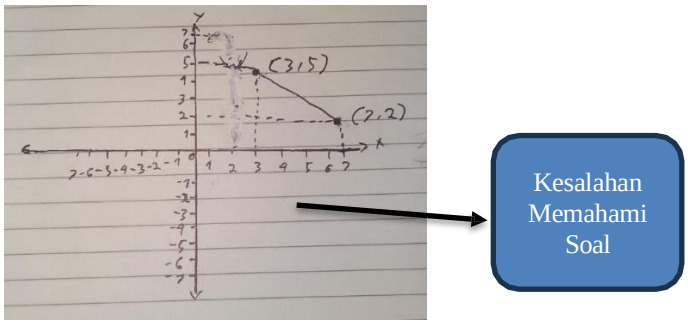

Figure 2. Errors of undergraduate students on question number 2

Based on the results of the test and interviews conducted by the researcher to S1, it can be seen that S1 can read the questions well, S1 is also able to understand what is known from the questions but does not reach the completion of the answer, so S1 can only draw, when interviewed further the student does not know the meaning of the questions given and does not know how to solve them. S1 only draws Cartesian coordinates and determines the points on the coordinate image. This can be concluded that S1 made a mistake in understanding the question because the student does not know the mathematical concept and what formula should be used to answer the question.

The following are the answers from S1 student number 3:

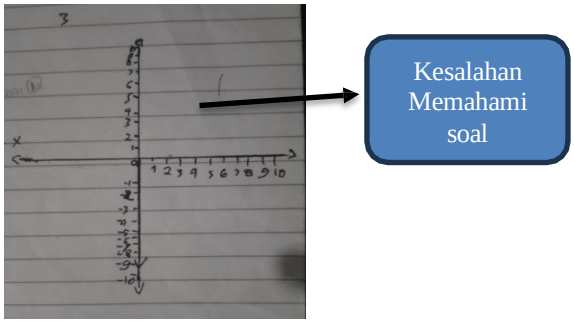

Figure 3. Undergraduate Students' Mistakes in Question Number 3

Based on the results of the test and the researcher's interview with S1 on question number 3. S1 students can read the questions well and correctly, S1 students can also find out what is known from the question but are wrong in determining what is asked from the question, namely S1 answered the picture, while what is asked from the question is the area of land used for tomato seedling nurseries. S1 also cannot work on the question based on the interview results. When interviewed, S1 knows the formula for the area of a rectangle but cannot apply it because he is confused about working on the question. Based on this description, it can be concluded that S1 made a mistake in understanding the question because the question requires students to determine the area of a rectangle based on the coordinate points in the question, not drawing coordinates and determining points without carrying out the process of solving the question correctly. This can be seen in the results of S1's work in the picture above where students only draw Cartesian coordinates but cannot determine the points in the question into the coordinate picture.

b. Description of Masters students in solving AKM questions

The following are the answers from S2 student number 1:

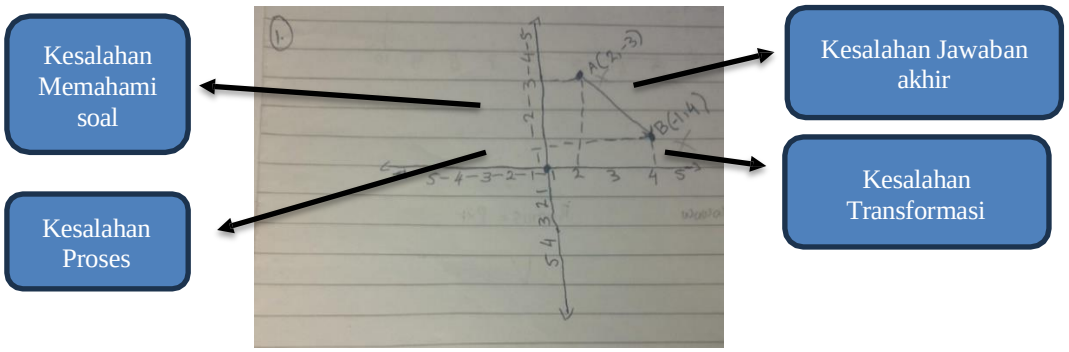

Figure 4. Errors of S2 students on question number 1

Based on the results of the test and the researcher's interview with S2 in number 1. It can be seen that S2 understands how to draw Cartesian coordinates, students are also able to transform known points into coordinate images. Based on the results of S2's work, students are able to draw Cartesian coordinates, but are wrong in determining the point S2 has not fully understood, namely the student answered on the answer sheet that point A (2,-3) and point B (-1,4) are in quadrant I. This is clearly wrong because point A (2,-3) is in quadrant IV and point B (-1,4) is in quadrant II. When interviewed S2 also did not know the location of the x-axis and y-axis in Cartesian coordinates. Based on this description, it can be concluded that S2 made a mistake in understanding the question, because S2 did not know the location of the x-axis and y-axis and did not know the location of points A and B in the quadrant. S2 also made a transformation error because the student incorrectly transformed the known point in the question into the coordinate image correctly. S2 was also wrong in the process of determining the known point into the Cartesian coordinate image. In writing the final answer, S2 also made a mistake, where the student was wrong in determining the point in the quadrant, automatically the student was wrong in drawing the line connecting the two points, the student also did not write the final conclusion of his answer. This can be seen in the picture of the student's test results above.

The following are the answers from S2 student number 2:

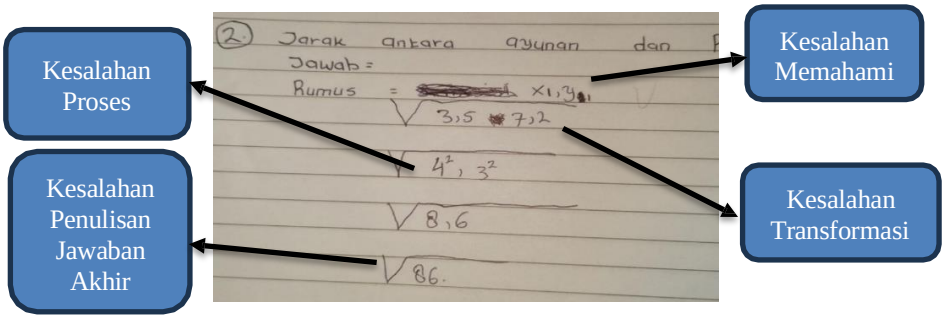

Figure 5. Errors of S2 students on question number 2

Based on the results of the test and interviews conducted by researchers with S2 students. It can be seen that S2 students can read questions well, S2 students also know what is known and asked from the questions even though they do not write it in the answer, S2 students can also determine the

formula to solve the question and can work on the question. Based on the results of the work and interviews, S2 made a mistake in understanding, where S2 students made a mistake in writing the formula, namely the student only wrote the formula for one point, namely x_1, y_1, when interviewed the student did not know the formula used. In the question, it is known that there are two points, so the formula that must be used to find the distance between the two points is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ .S2 students also made a transformation error, namely S2 students could not transform the question into a mathematical model correctly, where the student wrote $\sqrt{3{,}5 - 7{,}2}$, the student wrote the wrong mathematical operation sign according to the formula, S2 should have written $\sqrt{(7 - 3)^2 + (2 - 5)^2}$. S2 students also made mistakes in the problem solving process, where students made mistakes in operating known points, for example, 4^2students worked by multiplying directly by 2 so that it resulted in 8 when asked S2 answered directly multiplied. 4^2The result should have been 16 because 4^2it is a power number which means 4 is multiplied 2 times. Mistakes in writing the final answer, S2 was able to solve the problem but made a mistake in the process of working so that the student got the final result $\sqrt{86}$ should have been if the student was not wrong in determining the formula and could transform it into the formula correctly and did not make a mistake in the process of working then the result that should have been obtained was 5 units. Thus, S2 made a mistake in writing the final answer because it was based on previous mistakes. S2 also did not write the final conclusion of his answer.

The following are the answers from S2 student number 3:

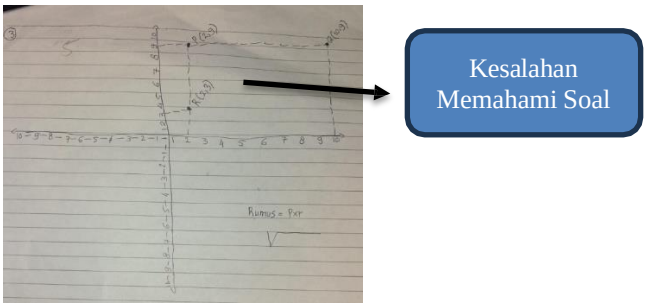

Figure 6. Errors of S2 students on question number 3

Based on the results of the researcher's test on S2 students. It can be seen that S2 students can determine what is known and asked correctly even though they do not write it on the answer sheet, S2 students can also draw Cartesian coordinates and can determine a rectangle based on known points in the question. S2 is also right in determining known points in coordinates and writing the formula for the area of a rectangle. Based on the results of the work and interviews, S2 made a mistake in understanding, namely that students did not understand the purpose of the question, where students when interviewed said that the way to solve the question was by drawing coordinates without doing the next process. In this question, students should first determine one of the unknown points, then students can calculate the area of the rectangle. S2 also did not know how to determine the area of a rectangle based on the results of the interview. In the results of S2's work, the formula for calculating

the area of a rectangle was written incorrectly, namely S2 wrote the formula = P x R, this is clearly wrong, where the formula for the area of a rectangle is length times width (P x L).

c. Description of Doctoral Students in Completing AKM Questions

The following are the answers from S3 student number 1:

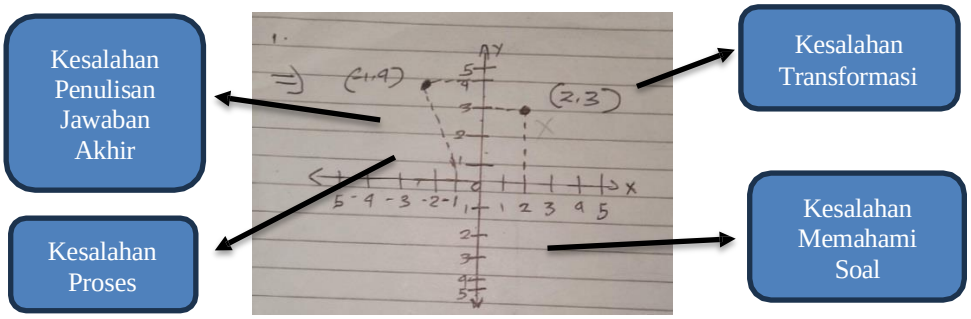

Figure 7. Errors of S3 students on question number 1

Based on the results of the researcher's test on S3 students. It can be seen that S3 understands how to draw Cartesian coordinates, students are also able to transform known points into Cartesian coordinate images. Based on the results of the test and interviews, it can be seen that S3 made a mistake in understanding the question, namely the student was wrong in determining the location of point A (2,-3) in the coordinates, where S3 based on the work results wrote that point (2,-3) is in quadrant I, this is clearly wrong because point (2,-3) is in quadrant IV. S3 also made a transformation error, namely the student was wrong in transforming the mathematical symbols known in the question into the coordinate image, where it is known from the question point A (2,-3) but the student wrote it in the coordinate image, namely (2,3), when interviewed it turned out that S3 was wrong and forgot to add a negative sign. S3 was also wrong in the process of determining the known points into the Cartesian coordinate image. In writing the final answer, S3 also made a mistake, namely not drawing a line connecting points A and B, because the question requires students to be able to draw the two known points and then connect them by a line. In addition, S3 was also wrong in determining the location of point B in coordinates, which automatically made the student wrong in writing the final answer. S3 also did not write the final conclusion of his work .

The following are the answers from S3 student number 2:

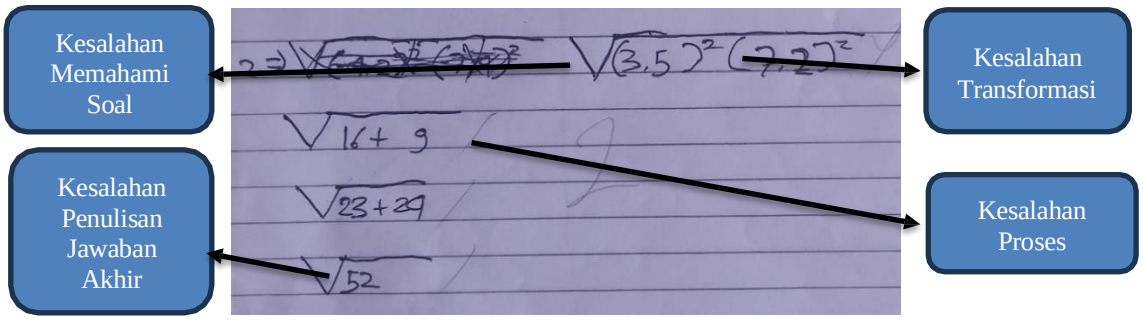

Figure 8. Errors of S3 students on question number 2

Based on the results of the test and interviews with S3 students. It can be seen that S3 students can determine the known points in the problem, S3 can also transform it into a mathematical model. S3

students made a mistake in understanding the problem, namely the students were wrong in determining what was asked from the problem, based on the results of the interview S3 answered that what was asked from the problem was a playground. S3 was also wrong in determining the point $x_1, x_2\ dan\ y_1, y_2$, where the student answered $x_1 = 3,\ x_2 = 5\ dan\ y_1 = 7, y_2 = 2$, it should be $x_1 = 3,\ x_2 = 7\ dan\ y_1 = 5,\ y_2 = 2$. S3 also could not determine the correct formula for solving the problem. Transformation error, namely student S3 made a mistake in transforming the formula and the known point where the student wrote it, $\sqrt{(3,5)^2\ (7,2)^2}$the student should have written it $\sqrt{(7 - 3)^2 + (2 - 5)^2}$. S3 also made a mistake in writing the operation sign, namely (3,5) it should be (3,-5). Process error, namely student S3 made a mistake in the process of solving the problem, where student S3 just did it, for example $(3,5)^2$how can a doctoral student get a result of 16. When interviewed, the doctoral student answered that he wrote it down without knowing how to do it, the student should have subtracted the number in brackets and then squared the result by two. Doctoral student also made a mistake in writing the final answer, based on previous mistakes, the doctoral student automatically made a mistake in writing the final answer, where the student's work results got$\sqrt{52}$ which comes from the results of the addition $\sqrt{23 + 2}$423 should be added to 24, the result is 47, not 52. The student also did not write the final conclusion of the results of his work. After being interviewed, it turned out that the S3 student did not know the formula for finding the distance between two points, the student was also still confused in determining the point into the formula.

The following are the answers from S3 student number 2:

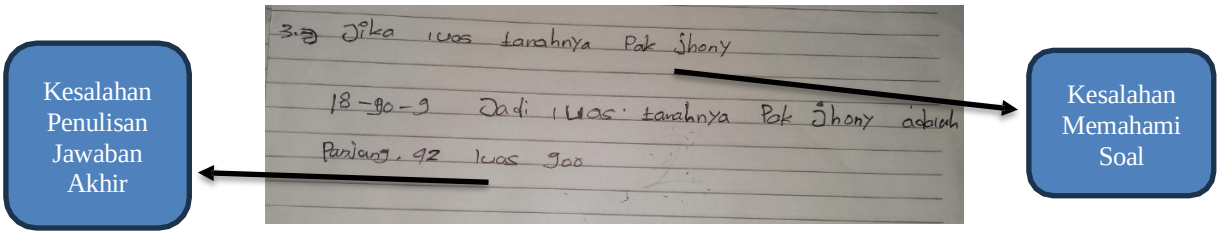

Figure 9. Errors of S3 students on question number 3

Based on the test results and interviews conducted by researchers with subject S3. It can be seen that S3 can determine what is known and asked from the question even though he did not write it on the answer sheet based on the interview results. S3 only wrote the final answer without carrying out the completion process with the correct formula and steps. S3 students also could not work on questions based on the correct steps. After being interviewed, it turned out that S3 made a mistake in understanding the question, this can be seen in the student's test results where the student was wrong in determining what was known and what was asked from the question. S3 could not work on the question and could not model the question into the correct formula and steps for solving the question. S3 just did it based on the interview results. S3 also made a mistake in writing the final answer, namely the student was wrong in getting the final result, this can be seen in the previous mistake, namely the student did not understand the question and did not know how to do it, the student only

wrote 18 - 90 - 9 when asked where to get it, the student answered just doing the question. S3 got a final result of 900 when asked how to get it, S3 answered just doing it like the previous answer.

Discussion

Based on the results of interviews with undergraduate, postgraduate and doctoral students, we can identify the mistakes made by students in detail based on Newman's theory, including the following:

a. Misunderstanding *(comprehension)*

Based on the results of the analysis of S1, S2, and S3 students, the types of student errors at this stage are; a) unable to determine what is known and asked in the question, b) unable to determine the formula used, c) wrong in determining the coordinate point, d) unable to determine the steps to solve the question, e) unable to know the material correctly. The errors made by students are caused by students not understanding the questions given correctly and not understanding the existing material well. This is in line with research Susilawati dkk. (2023)that when students do not know the meaning of the question from what is known and asked, then students have made a mistake in understanding.

b. Transformation *errors*

Based on the results of the analysis of S1, S2, and S3 students, the types of errors at this stage are; a) wrong in transforming known points into Cartesian coordinate images, b) wrong in transforming known points into problem solving formulas, c) wrong in using arithmetic operations and wrong in placing arithmetic operations in solving problems. This is in line with research conducted by Bernando dkk. (2022)namely the transformation errors made by students are that students are unable to create a mathematical model from the information known in the problem .

c. *Skill* Errors

Based on the results of the analysis of S1, S2, and S3 students, the types of student errors at this stage are; a) unable to apply the steps to solve the problem correctly, b) wrong in the calculation. Process errors made by students include students not knowing the number to the power of two and directly multiplying the number by its power only, there are also students who are wrong in transforming the formula so that in the process of working on the students experience confusion. This is in line with the opinion (Junaedi dkk. (2015)in his research that calculation errors are indicated by the inability of students to use the algorithm sequentially and correctly.

d. Final Answer *Encoding Errors*

Based on the results of the analysis of undergraduate, postgraduate, and doctoral students, types of student errors at this stage are; a) errors occur in the calculation process resulting in errors in determining the final answer, b) not writing the final conclusion. Students make mistakes in writing the final answer, namely writing the wrong final answer. This is in line with research conducted by Kristianto dkk. (2019)students solving problems but not writing the appropriate solution. There are

also students who do not write conclusions from the results of their work because the students do not understand how to write it.

Conclusion

Based on the results of research conducted on students of class VIII of SMP Negeri Fatumfaun, there are types of errors made by students in completing Minimum Competency Assessment questions based on *Newman's theory* carried out by students of class VIII of SMP Negeri Fatumfaun. The errors made by students include comprehension errors , namely students cannot understand the question so that students are wrong in determining what is asked in the question , students also do not understand the material well so that students are confused about how to solve the question. Transformation errors , namely students are unable to change the requested information into a mathematical model, students also do not remember the formula used and are unable to substitute the information given into the formula used. Process errors (*process skills*), namely students make mistakes in basic mathematical operations such as addition, subtraction, and multiplication. Final answer writing errors (*encoding*), namely students are unable to write conclusions from the results of the work that has been done and make writing errors in the final answer.

Reference

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