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The Evaluate Analysis of Problem Solving ability student and its Causes: A Case Study in Higher Middle School Student

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Abstract

Problem solving ability (PSA) is the ability that students have in solving problems related to mathematical concepts based on appropriate procedures. The aim of this research is to describe students' PSA as well as find out the types of errors made by students in working on PSA questions. The subjects in this research were 32 students of class XI MIPA 1 SMA Negeri 3 Denpasar. The data in this research was collected using PSA tests and interview drafts. This data was then analyzed using a qualitative descriptive approach. This research concluded that: 1) The average student PSA was 49.24 in the medium category, 2) the mistakes made by students were due to obstacles in processing mathematical processes and 3) the root of the problem was the lack of innovation in existing textbooks.

Keywords: *Problem Solving Ability, Error Analysis.*

INTRODUCTION

Mathematics is a basic science related to logic regarding shape, structure, quantity and a large number of other related concepts and is divided into three fields, namely algebra, analysis and geometry (Payadnya & Agung Ngurah Trisna Jayantika, 2022; Sariningsih & Herdiman, 2017; Trisna Jayantika, I G A N; Santhika, 2023). Therefore, students are expected to have cognitive abilities to solve problems that are good for training students' thinking abilities.

Problem-solving ability is an ability that allows students to find solutions that are carried out within their goals, it also requires readiness, creativity, knowledge and application in everyday life (Dewi et al., 2020; Lestari, 2015; Yarmayani, 2016). One of the goals of solving mathematical problems is to improve the ability to choose solutions with the right strategy (Novianti, 2017; Parwati et al., 2018). According to Branca, problem solving ability is a basic ability in learning mathematics, so this ability should be given, trained and accustomed to students as early as possible (Faoziyah, 2022).

Mathematical problem solving abilities have a very important role in various fields, especially Mathematics (Cheng et al., 2018). Problem solving abilities provide many benefits for students, because they can encourage creativity, flexibility and metacognitive thinking in accordance with the needs of daily life (Setiawan et al., 2021). Problem solving is important to develop because it helps students think analytically, which essentially means learning to reason and apply the experience and knowledge they have, think critically and creatively and develop other mathematical abilities (Mustofa, Mardiana, 2020).

PSA is so important, but there is still a problem of less than optimal PSA for students from primary to higher education (Murtafiah et al., 2023; Pramuditya, S.A; Noto, 2022). This problem must of course be studied as to the factors that cause it. One way is error analysis. Error analysis is carried out to understand the causes and roots of problems so that errors can be avoided or minimized. Previous research states that several factors cause students' low PSA, including process skills, problem understanding and problem transformation (Annisa; Prayitno, S; Kurniati, 2023; Ayu Lestari, A.R; Minggi, I; Qadry, 2019; Hartana, D.D.; Yenni; hartantri,

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2023; Vitaloka et al., 2020). However, in previous research error analysis was studied on the basis of student work results. The results of interviews with student representatives are really needed to find out more deeply the root causes of problems from mistakes made by students.

To address this challenge, an innovative solution is to examine student mistakes along with the results of interviews to complement the results of the study of student work results. The results of this research provide comprehensive information so that it can become the basis for further research, especially for research into the development of teaching materials, media and other learning tools that use mathematical problem solving ability as the dependent variable.

In the next section, we will discuss the theoretical framework which contains the theoretical basis of the variables used in this research, the methodology which explains the research design, research subjects, data collection and data analysis techniques. The results of this research are reviewed and discussed in the next section. In the final section, conclusions are presented which include the findings, limitations and recommendations for further research.

THEORETICAL FRAMEWORK

Problem Solving Ability

Mathematical problem solving ability is a fundamental cognitive ability that can be trained and developed in students, so that they are expected to be able to solve mathematical problems in everyday life (Liu & Ilyas, 2020). Solving problems can be seen as a process where students find a combination of previously learned rules that are used to solve new problems. Problem-solving abilities that students must have include the ability to overcome any problems related to their education, including problems in learning activities (Lestari, 2021; Purnami et al., 2017). In learning, students often ignore the process rather than the final answer they get. So clear stages are needed in the process of solving mathematical problems.

The stages of problem solving according to Polya, namely understanding the problem/reading the problem, preparing a plan/choosing a strategy, implementing the plan/solving the problem and checking again (Lusi Nuraeni et al., 2020). A description of each stage is presented in the following table.

Table 1. description of the PSA indicator

SN	PSA Steps	Description
1	Understanding the Problem	students read the problem carefully, identify the information provided, and determine what needs to be solved
2	Make a Plan	Students choose the right method or approach based on the characteristics of the problem they are facing.
3	Implementing the Plan	Students apply the steps necessary to solve problems systematically and logically.
4	Recheck Answer	Students recheck the steps they have taken, retest the solution to ensure its correctness and accuracy, and evaluate whether the solution meets the requirements given in the problem.

So, mathematical problem solving ability can be defined as the ability that students have in solving problems related to mathematical concepts based on appropriate procedures.

Error analysis according to the Newman Procedure

Error analysis is the activity of explaining in depth the types of errors and also what factors are the causes of errors made (Amir, 2015). Error analysis can also be interpreted as an activity to investigate the factors that cause students to make errors or omissions (E.Kristianto, Mardiyana, 2019; Fallo et al., 2021; Imanudin et al., 2023; Kristianti, L., W; Retnawati, 2020).

The Newman Procedure has several advantages in error analysis, especially in the context of mathematics education, including: (1) Comprehensive identification, the Newman Procedure allows comprehensive identification of errors made by students; (2) problem solving hierarchy, this procedure follows a systematic problem solving hierarchy, starting from reading the problem, understanding what is read, changing the problem into mathematical form, processing the chosen mathematical form, and writing the answer in an

acceptable form; (3) avoid repeating the same mistakes, this procedure can avoid the same mistakes; (4) improving learning, error analysis using the Newman procedure can be used as a means to improve existing learning and overcome errors made by students in solving mathematics problems; (5) teach students to correct mistakes, understanding mistakes allows students to understand the right concept.

Prakitipong and Nakamura stated that there are five types of errors according to Newman which are divided into two groups of obstacles experienced by students. The first obstacle is a problem in linguistic fluency and conceptual understanding that corresponds to a simple reading level and understanding the meaning of the problem. This first obstacle can be related to the type of error in reading the problem (reading) and understanding the problem (comprehension). The second obstacle is the problem in processing mathematics which consists of the problem transformation error type (Transformation), process skills (process skills) and writing answers (encoding) (Prakitipong & Nakamura, 2006; Sukariyanto, 2021; Widiawati et al., 2020). A description of each error type is presented in the table below.

Table 2. description of the Error Type by Newman

SN	Obstacle Type	Error Type	Error Description
1	Linguistic or language fluency	Reading the Problem	Learners make mistakes in reading and defining terms, symbols and important information in the problem.
2		Understanding the Problem	Learners make mistakes in mentioning known information and determining what is asked by the problem.
3	Processing mathematics	Problem transformation	Learners make mistakes in choosing a relevant problem solving plan to solve the problem in the problem
4		Process skills	Learners make mistakes in translating the problem solving plan well
5		Conclusion Writing	Learners make mistakes in checking back and drawing conclusions

METHOD

Research Subject

The subjects of this research were all 32 students of class XI MIPA 1 SMA Negeri 3 Denpasar. This selection was based on the consideration that class XI MIPA 1 students interpreted the conditions of class XI students at SMA Negeri 3 Denpasar, both from the characteristics and cognitive abilities of the students.

Research Design

This research is descriptive research which aims to describe students' mathematical problem solving abilities as well as the types of errors made by students according to the Newman procedure. This research was carried out using a Mix-Method approach. This approach is used because this research combines quantitative and qualitative approaches.

Data Collection

The types of data in this research are quantitative and qualitative data. Quantitative data in the form of problem solving ability scores collected using problem solving ability tests. Qualitative data consists of the results of interviews with students collected using interview drafts.

Data Analysis Technique

The collected PSA data was analyzed quantitatively by calculating the average score using the formula below

$$\bar{X} = \frac{\sum X}{n} \quad (1)$$

These means are further categorized using the following guidelines.

Table 3. PSA Score Conversion Guide

No	Score Range	Convertion
1.	$75 \leq \bar{X} \leq 100$	Very High
2.	$58 \leq \bar{X} < 75$	High
3.	$42 \leq \bar{X} < 58$	Medium
4.	$25 \leq \bar{X} < 42$	Low
5.	$\bar{X} < 25$	Very Low

Next, the work results of students with high - very high, medium and low - very low abilities were analyzed for the types of errors made using the Newman procedure. The results of studies using the Newman procedure can be used as a study in detecting PSA stages according to Polya. The PSA detection framework uses error types according to the Newman Procedure presented in the table below.

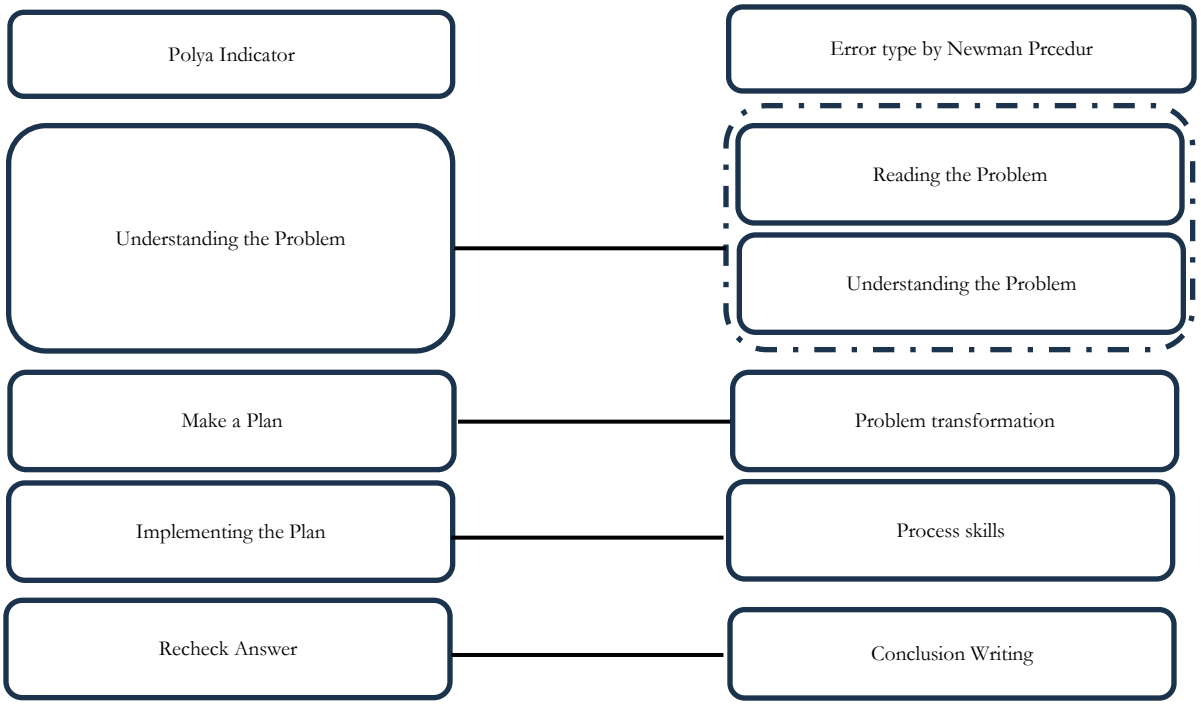

Figure 1. The PSA detection framework uses error types according to the Newman Procedure

Students were also interviewed to obtain qualitative data to clarify the results achieved on the problem solving ability test. There were 6 students interviewed, who came from students with high – very high (2 people), medium (2 people) and low – very low (2 people) abilities. Interviews were conducted after data analysis of problem solving abilities was carried out over a period of 2 days. This is done in order to obtain valid data because it is closely related to students' problem solving abilities.

RESULTS AND DISCUSSION

The results of data analysis regarding students' problem solving abilities showed that the average score was 49.24. Based on the conversion guide in table 1, the average score is categorized as medium. The distribution of students' problem solving ability scores can be seen in the table below.

Table 4. PSA Score Conversion Guide

SN	Category	Frequency	Percentage (%)
1	Very High	2	6,25
2	High	10	31,25
3	Medium	11	34,375
4	Low	7	21,875
5	Very Low	2	6,25

Total	32	100

The results from table 4 can be presented in the following diagram.

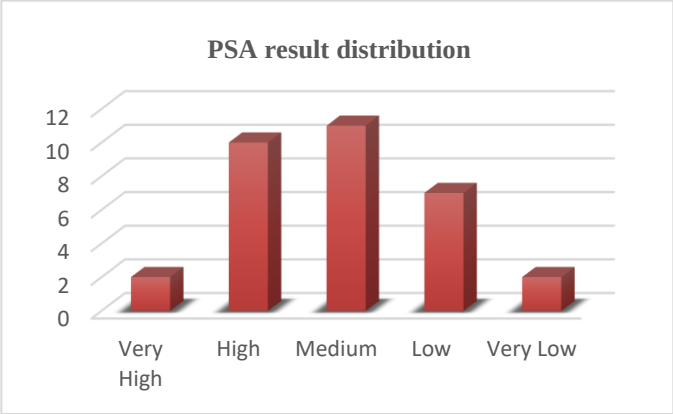

Figure 2. Distribution of PSA Test Results

From the results of the distribution of scores in table 3 and figure 1, it can be seen that the greatest frequency is in students with moderate ability. The average results obtained showed that students experienced problems related to mathematical problem-solving skills. This result is in line with the results of previous research that the PSA of students from primary to higher education in Indonesia still tends to be low (Murtafiah et al., 2023; Pramuditya, S.A; Noto, 2022).

There are many factors that cause low PSA students. To find out, a qualitative analysis of the students' work results was carried out. The analysis was carried out based on the Newman procedure. The results of this analysis are presented as follows.

Error Analysis According to Newman Procedure

Error analysis is carried out by Newman procedure. There were six student jobs whose errors were analyzed. These students come from high, medium and low ability students. The following questions are given to students.

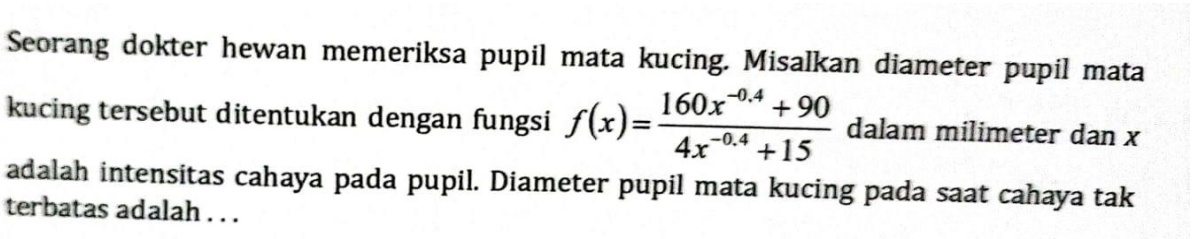
Seorang dokter hewan memeriksa pupil mata kucing. Misalkan diameter pupil mata kucing tersebut ditentukan dengan fungsi $f(x)=\frac{160x^{-0.4}+90}{4x^{-0.4}+15}$ dalam milimeter dan x adalah intensitas cahaya pada pupil. Diameter pupil mata kucing pada saat cahaya tak terbatas adalah . . .

Figure 3. PSA Questions

Translation

A veterinarian examines a cat's pupils. Suppose the diameter of the pupil of the cat's eye is determined by the function in millimeters and x is the intensity of light at the pupil. the diameter of the pupil of a cat's eye in infinite light is . . .

The results of the analysis for each of the six students consisting of 2 students each with high, medium and low PSA are presented as follows.

T1 (Students with high PSA)

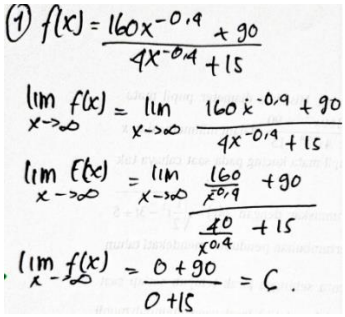

Figure 4. student work result T1

From these results, it can be seen that T1 students are able to write the questions correctly and translate the statement "at the time of infinite light" into an infinite limit. Although T1 did not explicitly mention what was known and asked. From this initial process, it can be seen that T1 has enough understanding to solve the given problem. From the calculation and operation process, T1 has provided the right process. However, T1 has not been able to conclude the results obtained. Which means that the results of the calculation process carried out are not a complete solution to the problem given. From the results of this error analysis, T1 students were less than optimal in recheck aswer according to the PSA indicator from Polya. T1 students are advised to be careful and keep checking the answers that have been written before.

Furthermore, an interview was conducted between teacher P and student T1 with the following excerpts from the interview.

P : How do you feel about the PSA test?

T1 : It is quite difficult to understand the problem, because teachers rarely discuss PSA questions. Although in some textbooks there are PSA questions.

P : Have you never practiced problems independently?

T1 : Rarely sir. Because of the teacher's lack of explanation, I find it difficult to learn independently. Several times I used videos on YouTube, but many of the videos I found did not match the material I needed.

P : Talking about existing teaching materials, can you convey the type of teaching materials you have now?

T1 : The books I have are in accordance with those given at school, namely package books and worksheets.

P : What do you think you need in a textbook to increase your willingness to learn independently?

T1 : If possible, the teaching material has a direct learning video, so that I am no longer confused about looking for videos on YouTube.

From the excerpt of the interview with T1 above, it can be seen that the mistakes made by T1 were caused by the lack of practice problems he did. In detail, it can be said that this problem is rooted in the rarity of teachers discussing PSA problems and the availability of teaching materials that can accommodate students' willingness to learn independently.

So, the problem faced by student T1 is at the conclusion writing stage. This is due to the lack of experience of T1 students in working on PSA problems and the lack of independence of T1 students to repeat studying the material again at home.

T2 (Students with high PSA)

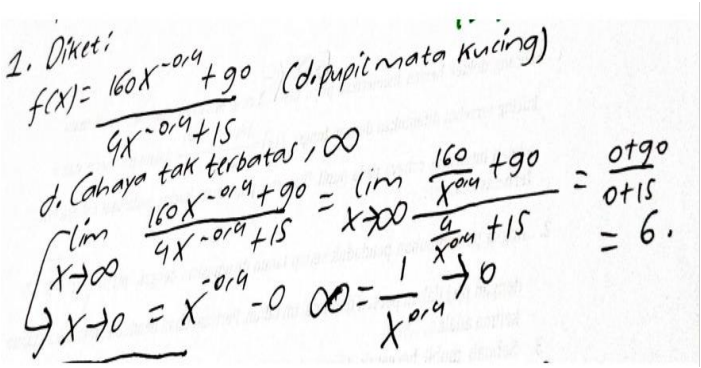

Figure 5. student work result T2

Student T2 was correct in writing the function in the problem, which means that student T2 was able to read the problem well. However, there is doubt in translating what is asked by the problem. This can be seen from the answers of T2 students who provide two limit approaches, namely limits approaching infinity and zero. So that student T2 does not have a full understanding in planning the solution to the problem given. Figure 3. student work result T2.

In the process of calculating the limit value, student T2 has done the right calculation, where the form of changed to which is then substituted for the value of ∞. However, at the end of the process, T2 students did not provide conclusions from the problem at hand. T2 students have not been maximized at the make a plan stage on the polya indicator. So that T2 students should strengthen their understanding related to the transformation of mathematical problems through problem-solving-based problems.

Furthermore, student T2 was interviewed to explore qualitative information. The following is an excerpt from the interview teacher P with student T2.

P : Are there any obstacles in solving the PSA problem given?

T2 : Quite a lot of obstacles, sir. I was still hesitant to determine the limit approach used. And I think the solution is finished just by completing the limit calculation process.

P : Can you tell us what are the factors that cause your PSA achievement?

T2 : I think there is a lack of practice on PSA problems. At school, similar problems are rarely given, and at home I rarely study again.

P : What causes you to rarely study at home?

T2 : The textbook is not interesting, sir. And the book only contains writing.

P : What do you want in a textbook?

T2 : The textbook should have a video, so that when studying at home you can read the material and watch the video. Textbooks can also be more interesting because the content is not only written.

From the interview excerpt above, it can be seen that the less than optimal PSA achievement of T2 students is caused by the lack of intensity of students in practicing PSA problems, as well as the rarity of teachers discussing PSA problem types. Furthermore, the existing textbooks so far still contain only writing, and videos need to be integrated in them so that they can be more interesting.

So, the errors faced by T2 students are in problem transformation and final conclusion drawing. This error is partly due to the lack of experience of students in solving PSA problems.

S1 (Students with medium PSA)

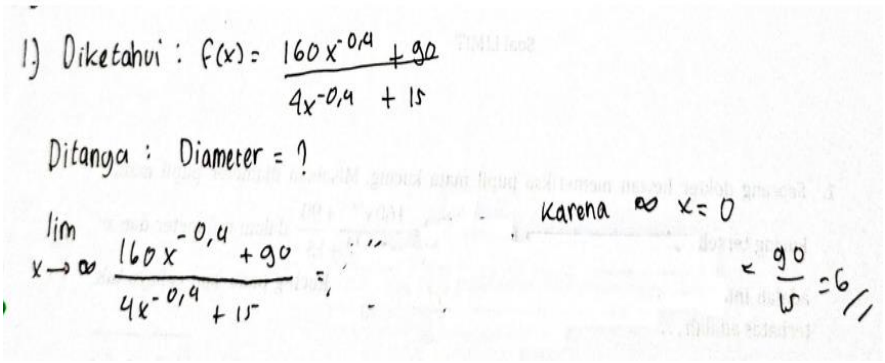

Figure 6. student work result S1

From the results of the work above, it can be seen that S1 students have been able to write down the functions of the questions correctly and in determining the limit approach they are looking for. However, S1 students did not include the proper calculation process, and there was no conclusion that was able to answer the problems given. Judging from the Polya indicator, S1 students have not been maximized on the indicator implementing the plan and recheck answer. Furthermore, S1 students should learn more about the process of mathematical calculation and be more careful in checking the answers they have done.

Furthermore, an interview was conducted between teacher P and student S1 with the following excerpts from the interview.

P : What are the obstacles you face when working on KPM questions?

S1 : I was confused about working on it, because I rarely encounter this type of problem. Teachers also rarely discuss PKM questions.

P : Do you try to study independently to learn concepts that are not discussed in class?

S1 : I rarely study independently sir.

P : What do you think is the reason?

S1 : The teaching materials available are less interesting so I rarely restudy the material taught in class.

P : What do you think interesting teaching materials are?

S1 : A book in which there is a video equipped with a discussion of the questions. It's even better if the book has media

From the interview excerpt above, it can be seen that S1 students experience problems in PSA achievement, one of which is caused by the lack of practice intensity, both in the learning process at school and repetition at home. Furthermore, in the learning process at school, students admit that teachers rarely provide experiences for students related to the PSA test. For learning at home, students mentioned that the lack of interesting teaching materials available has reduced the interest of S1 students to study independently.

So, the types of errors made by S1 students are process skills and inference. Student S1 did not include the calculation process and did not draw the conclusions obtained. This is caused by teaching materials that are less interesting.

S2 (Students with medium PSA)

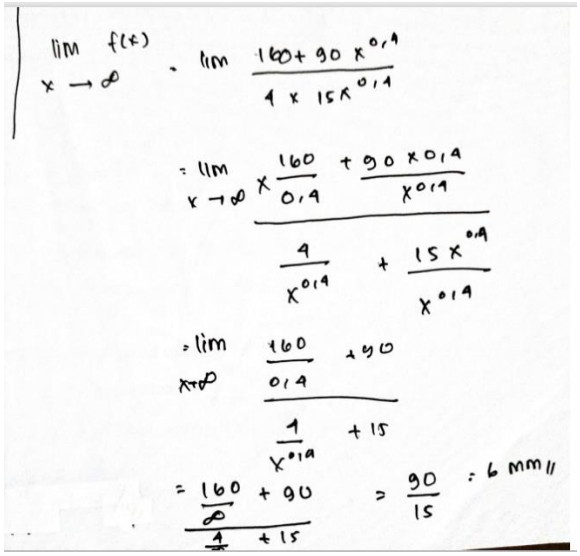

Figure 7. student work result S2

From the results of S2 students' answers above, it can be seen that S2 students did not write the function correctly according to the problem given. S2 students have correctly planned the solution with the infinite limit approach. The process skills shown by S2 students are still not correct. There are several mistakes made, for example writing the denominator form of the function to be . At the end of the answer, S2 students did not provide a conclusion that answered the problem given by the problem. In the PSA indicator, according to Polya, S2 is still not optimal in implementing the plan and recheck answer.

Furthermore, this S2 student was interviewed to get further conditions from this student. The following is an excerpt from the interview between teacher P and student S2.

P : How was your PSA test result?

S2 : Not satisfactory sir.

P : What part of the problem did you have difficulty with?

S2 : The difficulty is in the steps of solving the problem.

P : Do you regularly practice this type of PSA problem?

S2 : I rarely practice PSA problems at home.

P : What causes the lack of practice problems that you do?

S2 : The teaching materials are not interesting sir. Maybe if the teaching materials can be integrated with online features such as videos, media or games.

From this interview excerpt, information was obtained that the difficulties experienced by S2 students were caused by the lack of practice problems made so that it was difficult to understand the steps of solving the problem. Student S2 also mentioned that the existing teaching materials were not interesting. According to student S2, teaching materials can be integrated with online features such as videos, media or games to make teaching materials more interesting.

So, S2 students made mistakes in the types of reading problems, process skills and drawing conclusions. The unsatisfactory achievement of the PSA test is due to the lack of intensity of practice carried out by S2 students. Furthermore, the lack of interesting teaching materials available has implications for S2 students' lack of interest in doing problem exercises independently.

R1 (Students with low PSA)

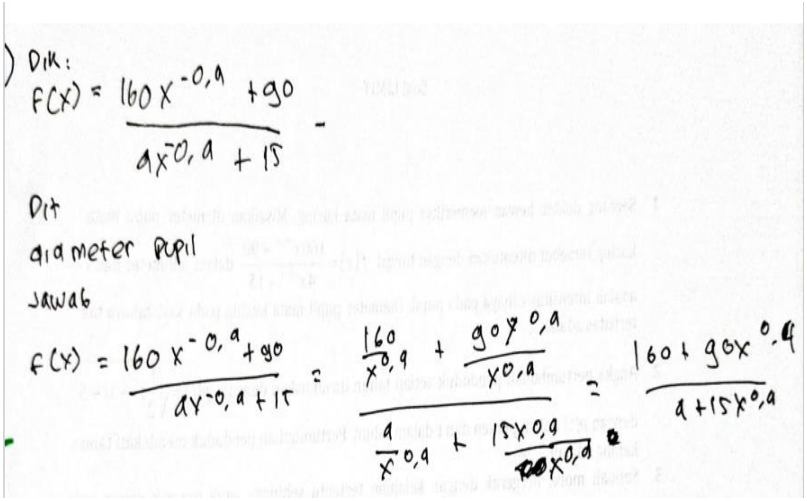

Figure 8. student work result R1

From the results of student R1's answers above, it can be seen that student R1 made errors in the types of problem transformation, process skills and inference. In the given problem, student R1 did not solve the problem with the concept of infinite limit but with an unclear concept. Likewise with the process skills performed. Student R1 did not carry out the process that led to the solution of the problem given. This has implications for the conclusion drawing that was not carried out by student R1.

Furthermore, student R1 was interviewed to obtain qualitative data about student R1's response to the achievements in the PSA test. The following is an excerpt of the interview between teacher P and student R1.

P : What caused your less than optimal achievement on the KPM test?

R1 : This type of question like the KPM test is rarely given at school, sir. So I was confused in interpreting the questions given.

P : If it is rarely given at school, do you study independently at home?

R1 : No, sir.

P : Why don't you study independently at home?

R1 : Because the current textbooks are less interesting so I'm lazy to study at home.

P : What kind of textbooks do you currently get?

R1 : Textbooks and LKS in printed version

From the interview excerpt above, it can be said that student R1 rarely gets experience in answering PSA questions. At school, R1 students rarely get experience answering PSA questions from the teacher. At home, R1 students never study independently. This is due to the lack of interesting textbooks he received.

So the errors made by R1 students made mistakes in the type of problem transformation, process skills and inference. One of the efforts that can be made is to provide innovative teaching materials so that students are interested in learning PSA questions.

R2 (Students with low PSA)

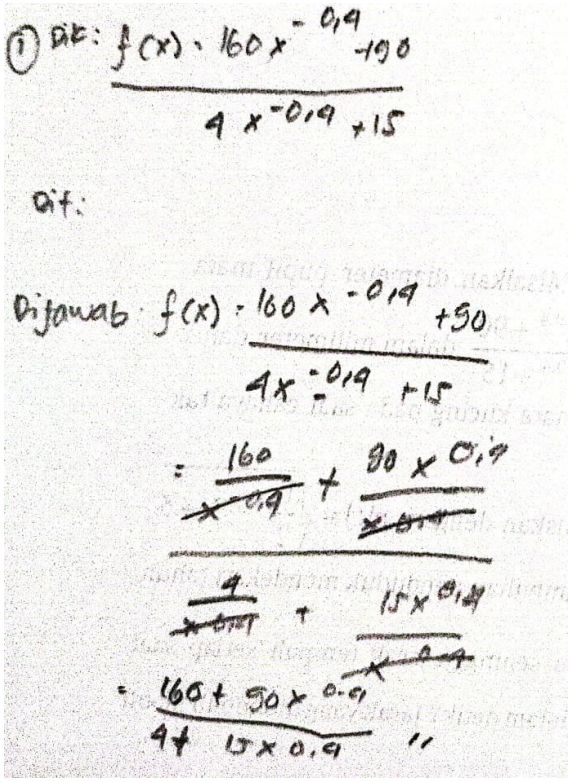

Figure 9. student work result R2

From the results of student R2's answers above, it can be seen that students make mistakes in the type of problem transformation, process skills and inference. Student R2 did not solve the problem with the infinite limit approach, but with an approach whose process was not directed. This is followed by a calculation process that is also inappropriate. So that R2 students are confused in concluding the solution to the problem given. In addition, R2 students also did not understand the question in the problem which asked about "when Light is infinite". R2 students should use the infinite limit approach, but in fact R2 students use another solution approach.

Student R2 was then interviewed to obtain qualitative student responses related to student achievement on the PSA test. The following is an excerpt of the interview between teacher P and student R2.

P : Are you satisfied with the PSA test results?

R2 : Very unsatisfactory, sir.

P : What do you think caused this unsatisfactory achievement?

R2 : I didn't practice and deepen the material so it was very lacking in the aspect of understanding the material.

P : Why don't you practice independently to complete the concepts taught at school?

R2 : The existing teaching materials lack discussion of questions about PSA and the lack of online learning resources such as videos. So I am less interested in practicing independently.

From this interview excerpt, it can be said that student R2 got unsatisfactory results due to lack of practice. Furthermore, student R2 conveyed that the existence of online media in teaching materials is a necessity that can attract students' interest in learning. In contrast, the teaching materials that Student R2 has at this time still do not have a digital element so that it is less interesting to study independently.

So, the mistakes made by R2 students are of the problem transformation, process skills and inference types. This is due to the lack of practice that R2 students do, where the root of the problem is in the lack of interesting teaching materials to learn.

From the results of the error analysis above, the following is a summary of the types of errors made by the sample subjects.

Table 5. Recapitulation of Error Analysis of Research Subjects

Sample Subject	Error Types by Newman Procedure				
	Reading the Problem	Understanding the Problem	Problem transformation	Process skills	Conclusion Writing
T1					√
T2			√		√
S1				√	√
S2	√			√	√
R1			√	√	√
R2			√	√	√

Error types according to Newman are grouped into two constraints, namely constraints in linguistic or linguistic fluency (types of reading problems and understanding problems) and constraints in processing mathematical processes (types of problem transformation errors, process skills and inference).

From the recapitulation results in table 4 above, it can be seen that the research subjects made more mistakes on the mathematical process constraints. This result is in line with the previous study that junior and senior high school students tend to have the type of errors on the mathematical process constraints (E.Kristianto, Mardiyana, 2019; Kristianti, L., W; Retnawati, 2020). Conversely, there are also studies that conclude that the dominant errors are in problem understanding (Hartana, D.D.; Yenni; hartantri, 2023; Sari et al., 2022; Sukariyanto, 2021).

According to Polya's PSA indicator, here is a recapitulation of the PSA sample subjects' abilities

Table 6. Summary of PSA analysis results

Sample Subjects	Indicator PSA by Polya				suggestion
	Understanding the Problem	Make a Plan	Implementing the Plan	Recheck Answer	
T1				-	• to be careful and keep checking the answers that have been written before
T2		-		-	• to be careful and keep checking the answers that have been written before • strengthen their understanding related to the transformation of mathematical problems through problem-solving-based problems.
S1			-	-	• to be careful and keep checking the answers that have been written before • improve the mathematical calculation process
S2	-		-	-	• to be careful and keep checking the answers that have been written before. • improve the mathematical calculation process • read more and do PSA questions
R1		-	-	-	• to be careful and keep checking the answers that have been written before • strengthen their understanding related to the transformation of mathematical problems through problem-solving-based problems • improve the mathematical calculation process
R2		-	-	-	• to be careful and keep checking the answers that have been written before

					• strengthen their understanding related to the transformation of mathematical problems through problem-solving-based problems • improve the mathematical calculation process

The results above indicate a recapitulation of the job analysis findings for the sample subjects The gray-colored section indicates areas where Polya's indicators were not optimal in the sample subjects This research outcome provides a basis for further studies, particularly those aimed at addressing issues related to student PSA

CONCLUSION

The average PSA of students is 49.24 with a moderate category. From the distribution of individual PSA test results, 6.25% of students were categorized as very high, 31.25% were categorized as high, 34.375% were categorized as medium, 21.875% were categorized as low and 6.25% were categorized as very low. Furthermore, an error analysis according to Newman's procedure was carried out by students. From the results of the error analysis carried out, the errors made by students are in the constraints of processing the mathematical process. From the results of the interviews conducted, the root cause lies in the lack of interesting teaching materials available, causing a sense of disinterest in doing problem exercises independently. This certainly has implications for the low achievement of students on the PSA test given. From the results of this study, the development of teaching materials should be able to develop the ability to process mathematical processes and have attractive features so that it can increase students' interest in learning independently.

This research is still limited to analyzing problem solving skills on the topic of limits and with the Newman procedure. Future researchers can develop this error analysis on different topics and procedures.

REFERENCES

Annisa; Prayitno, S; Kurniati, N. A. (2023). Analisis Kesalahan dalam Menyelesaikan Soal Cerita Matematika Materi Relasi dan Fungsi Berdasarkan Prosedur Newman ditinjau dari Perbedaan Gender Pada Siswa Kelas VIII SMP Negeri 22 Mataram Tahun Pelajaran 2021/2022. Jurnal Ilmiah Profesi Pendidikan, 8(1), 323–334.

Ayu Lestari, A.R; Minggi, I; Qadry, I. . (2019). Analisis kesalahan dalam menyelesaikan soal cerita materi bangun ruang sisi datar berdasarkan prosedur newman. SIGMA (Suara Intelektual Gaya Matematika), 11(2), 122–129.

Cheng, S., She, H., & Huang, L. (2018). The Impact of Problem-Solving Instruction on Middle School Students ' Physical Science Learning : Interplays of Knowledge , Reasoning , and Problem Solving. 14(3), 731–743. https://doi.org/10.12973/ejmste/80902

Dewi, N. R., Mulyono, M., Ardiansyah, A. S., Parwati, N. N., Mariawan, I. M., Lan, X., & Zhou, Y. (2020). Analysis of Early Mathematical Problem-Solving Ability in Mathematics Learning for Junior High School Student Analysis of Early Mathematical Problem-Solving Ability in Mathematics Learning for Junior High School Student. Journal of Physics: Conference Series, 1554(012026). https://doi.org/10.1088/1742-6596/1554/1/012026

E.Kristianto, Mardiyana, S. (2019). Analysis of Students ' Error in Proving Convergent Sequence using Newman Error Analysis Procedure Analysis of Students ' Error in Proving Convergent Sequence using Newman Error Analysis Procedure. Journal of Physics: Conference Series, 1180(012001), 1–7. https://doi.org/10.1088/1742-6596/1180/1/012001

Fallo, S. K., Fitriani, F., & Amsikan, S. (2021). Prosedur Newman: Analisis Kesalahan Siswa Dalam Menyelesaikan Soal Bangun Ruang Prisma. MATH-EDU: Jurnal Ilmu Pendidikan Matematika, 6(3), 89–99. https://doi.org/10.32938/jipm.6.3.2021.89-99

Faoziyah, N. (2022). Kemampuan Pemecahan Masalah Matematis Siswa Melalui Pembelajaran Berbasis Pbl. JUPE : Jurnal Pendidikan Mandala, 7(2). https://doi.org/10.58258/jupe.v7i2.3555

Hartana, D.D.; Yenni; hartantri, S. . (2023). Analisis Kesalahan Menyelesaikan Soal Cerita Matematika melalui Prosedur Newman pada Siswa Sekolah Dasar. Jurnal Basicedu, 7(3), 1539–1548.

Imanudin, D., Studi, P., Matematika, P., & Karawang, U. S. (2023). Timur dalam menjawab soal timss berdasarkan. 9(1).

Kristianti, L., W; Retnawati, H. (2020). An analysis of students ' error in completing the contextual problems based on Newman ' s procedure An analysis of students ' error in completing the contextual problems based on Newman ' s procedure. Journal of Physics: Conference Series, 1511(012036), 1–10. https://doi.org/10.1088/1742-6596/1511/1/012036

Lestari, I. (2015). Pengaruh Waktu Belajar dan Minat Belajar terhadap Hasil Belajar Matematika. Formatif: Jurnal Ilmiah Pendidikan MIPA, 3(2), 115–125. https://doi.org/10.30998/formatif.v3i2.118

Lestari, I. (2021). Experiential learning using STEM approach in improving students ' problem solving ability Experiential learning using STEM approach in improving students ' problem solving ability. https://doi.org/10.1088/1742-6596/1806/1/012005

Liu, A. N. A. M., & Ilyas, I. (2020). Pengaruh Pembelajaran Online Berbasis Zoom Cloud Meeting Terhadap Hasil Belajar Mahasiswa Fisika Universitas Flores. Jurnal Pendidikan Fisika Dan Keilmuan (JPFK), 6(1), 34. https://doi.org/10.25273/jpfk.v6i1.7303

Lusi Nuraeni, Huri Suhendri, & Aulia Masruroh. (2020). Analisis Kemampuan Pemecahan Masalah Matematik Peserta Didik Kelas Viii Smp. Jurnal Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika, 1(3), 159–171. https://doi.org/10.46306/lb.v1i3.34

Murtafiah, W., Diah, N., Lestari, S., & Yahya, F. H. (2023). How do students ' decision-making ability in solving open-ended problems ? Journal of Mathematics Education, 12(1), 133–150.

Mustofa, Mardiana, S. (2020). An analysis of problem solving ability in linear equation systems with two variables An analysis of problem solving ability in linear equation systems with two variables. https://doi.org/10.1088/1742-6596/1538/1/012099

Novianti, D. E. (2017). Profil Pemecahan Masalah Matematika Dalam Menyelesaikan Permasalahan Pemrograman Linear Ditinjau Dari Kemampuan Komunikasi Matematis Mahasiswa. JIPM (Jurnal Ilmiah Pendidikan Matematika), 6(1), 53. https://doi.org/10.25273/jipm.v6i1.1698

Parwati, N. N., Sudiarta, I. G. P., Mariawan, I. M., & Widiana, I. W. (2018). Local wisdom-oriented problem-solving learning model to improve mathematical problem-solving ability. Journal of Technology and Science Education, 8(4), 310–320. https://doi.org/10.3926/jotse.401

Payadnya, I. P. A. A., & Agung Ngurah Trisna Jayantika, I. G. (2022). How do Digital Native Students Responses to Balinese Ethnomathematics Problems? Jurnal Pendidikan Progresif, 12(2), 785–795. https://doi.org/10.23960/jpp.v12.i2.202230

Prakitipong, N., & Nakamura, S. (2006). Analysis of Mathematics Performance of Grade Five Students in Thailand Using Newman Procedure. Journal of International Cooperation in Education, 9(1), 111–122.

Pramuditya, S.A; Noto, M. S. A. . (2022). Characteristics of students' mathematical problem solving abilities in open-ended-based virtual reality game learning. Journal of Mathematics Education, 11(2).

Purnami, A. S., Studi, P., Matematika, P., Sarjanawiyata, U., & Yogyakarta, T. (2017). Pengaruh strategi metakognitif terhadap kemampuan pemecahan masalah matematika ditinjau dari persepsi siswa terhadap pelajaran matematika. 5(2), 183–194.