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An Analysis of Reflective Thinking and Literacy Competencies in Inquiry Learning Model Applications

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Abstrak

Penelitian bertujuan untuk mendeskripsikan jawaban siswa dalam menyelesaikan masalah berpikir reflektif dan literasi materi teorema Pythagoras, mengurangi kesalahan siswa dalam menyelesaikan tes berpikir reflektif dan kemampuan literasi matematis melalui penerapan model pembelajaran inkuiri. Penelitian ini menggunakan pendekatan kualitatif. Subjek dalam penelitian ini adalah siswa kelas VIII-1 MTs Abata Al Washliyah tahun ajaran 2024/2025 yang berjumlah 30 orang. Hasil penelitian sebagai berikut: jawaban siswa dalam berpikir reflektif dan literasi pada materi teorema Pythagoras pada indikator reacting, elaborating dan contemplating dan pada kemampuan literasi siswa menyelesaikan masalah pada indikator mampu menguraikan masalah secara sistematis; mampu menggunakan konsep, fakta, prosedur, dan penalaran dalam matematika; dan menafsirkan matematika untuk memecahkan masalah. Kesalahan kemampuan berpikir dan reflektif kemampuan Literasi dalm penerapan model pembelajaran inkuiri, siswa dengan kategori tinggi tidak mengalami kesalahan, pada kategori sedang, siswa mengalami kesalahan tarnsformasi, kesalahan ketrampilan proses, kategori rendah, siswa mengalami kesalahan memahami soal; kesalahan transformasi dan kesalahan ketrampilan proses.

***Kata Kunci**: Analisis, Kemampuan Relektif, Literasi, Inkuiri.*

Abstract

The study aims to describe students' answers in solving reflective thinking problems and literacy of the Pythagorean theorem material, reducing student errors in completing reflective thinking tests and mathematical literacy skills through the application of the inquiry learning model. This study uses a qualitative approach. The subjects in this study were 30 students of class VIII-1 MTs Abata Al Washliyah in the 2024/2025 academic year. The results of the study are as follows: students' answers in reflective thinking and literacy on the Pythagorean theorem material on the reacting, elaborating and contemplating indicators and on students' literacy skills in solving problems on the indicators of being able to describe problems systematically; being able to use concepts, facts, procedures, and reasoning in mathematics; and interpreting mathematics to solve problems. Errors in thinking and reflective literacy skills in the application of the inquiry learning model, students with high categories did not experience errors, in the medium category, students experienced transformation errors, process skill errors, low categories, students experienced errors in understanding questions; transformation errors and process skill errors.

***Keywords**: Analysis, Reflective Ability, Literacy, Inquiry*

A. Introduction

Thinking distinguishes humans from other living things. Thinking is essential to solve issues; therefore, developing this skill is crucial. This may measure math learning goals. (Simamora, R. E., Saragih, S., & Hasratuddin, 2018) defined thinking as the transition of complicated information between mental processes, including appraisal, abstraction, reasoning, imagination, and problem solving, to create new mental representations. (Utari, 2017)adds that thinking is more than remembering and comprehending.

Mathematical learning requires high-level reasoning. High-level cognitive abilities continue to improve. According to (Surya, E., & Syahputra, 2017), "Higher-order thinking skills include critical, logical, reflective thinking, metacognitive, and creative thinking." Reflective thinking is part of high-level thinking. Students may use mathematical reflective thinking to solve new issues connected to their existing knowledge. Reflective thinking is information or data used to reply that originates from inside (internal), may explain what was done, recognize flaws and repair them, and express concepts using symbols or pictures rather than direct objects (Masamah, 2017). Thus, introspective thinking is ideal for math difficulties. Educators must use a variety of activities to assess students' reflective thinking processes. Students may demonstrate reflective thinking by solving arithmetic questions, even ordinary ones. Reflective thinking allows pupils to use their knowledge to develop issues and find answers. (Widayat, 2018) said that reflective thinking demands students to work actively, constantly, and consistently and examine everything to solve a problem and find a suitable answer. So that as they think through the problem, students will gain or lose confidence in their ideas.

(Wahyuni, 2018) preliminary analysis of observations at SMP Negeri 3 Polanharjo Klaten demonstrates that instructors have not prioritized reflective thinking in mathematics learning goals. Junior high math instructors seldom use reflective thinking. This agrees with (Suharna, 2018) that reflective thinking exercises are typically ineffective and hard for students to master. In her exploratory research, (Kurniawan.R.I., Nindiasari.H., 2020) found that over 60% of high school pupils cannot perform mathematics reflective thinking tasks, including understanding, connecting, and evaluating. Teachers must develop pupils' reflective thinking, particularly in arithmetic. A 2000-to-2021 study of 15-year-old math, science, and reading literacy (Nurfatanah, Rusmono, 2018). Indonesia ranks lowest in math on PISA. Indonesian pupils' average math ability is level 1, meaning they can only answer problems in the general context with all necessary knowledge and properly worded questions (OECD, 2019). This indicates poor mathematics literacy among Indonesian pupils. Indonesian pupils can only tackle easy issues and are not accustomed to high-level thinking.

Literacy skills are an equally important aspect in learning mathematics. Based on this definition, mathematical literacy is the ability of students to formulate, use, and interpret mathematics in various contexts (Rahmah, 2016). This includes mathematical reasoning to

describe, explain, and predict phenomena. This helps someone to understand the role of mathematics in life and to make rational and logical judgments and decisions that are needed by constructive, actively involved, and reflective citizens (Yudi, Y.P & Rajab, 2020).

The state of student abilities in Indonesia is very concerning. The Ministry of Education and Culture, through the Indonesian National Assessment Program, showed that around 77.13% of elementary school students throughout Indonesia had very low mathematical competence; namely, 20.58% were sufficient, and only 2.29% were in the good category. (Branca, 2017) data in, representing 83% of the Indonesian population, also showed a mathematical emergency. The emergency occurred because the number of respondents who had less competence was very high. More than 85% of elementary school graduates, 75% of junior high school graduates, and 55% of high school graduates only reach the competency level of students in grade 2 and below.

The importance of mathematical literacy has not been balanced with the quality of education in Indonesia; this can be seen from various types of international-level assessments that are followed in Indonesia. The PISA results show that the mathematical literacy skills of Indonesian students are not optimal. In fact, mathematical literacy has a match between literacy and subject content standards because, in essence, the ability to be achieved in the content standards of mathematics learning objectives is mathematical literacy (Zahroh, H., Hafidah, 2020).

To find out the reflective thinking process and literacy skills of the research, an initial observation was first conducted at the target school of the research. From the results of the initial observation conducted by the research on junior high school students in grade VIII to see the analysis of reflective thinking skills and literacy skills, it can be seen from the results of the answers that the mistakes made by students in solving problems are mistakes in identifying the sides of the triangle and applying the concept of the Pythagorean theorem correctly. These students are unable to understand the questions because they are lazy to read questions related to mathematics. It can be seen from the pattern of students' answers during identification based on indicators of mathematical literacy skills (Masamah, 2017). From the results of the reflective thinking ability test and the students' literacy skills above, it turns out that they are still relatively low. Many factors cause low reflective thinking skills and literacy skills, including causing students to not be able to solve problems properly.

There are students who are not yet able to understand the problem, as seen from students writing down what is known and asked correctly. These students have not been able to plan a solution to the problem, the results of students' answers to the questions show that students have not been able to collect relevant information to solve the problem (Khasanah, 2018). There are also students who tend to immediately make the final solution without first. It is necessary to solve the above problems first, students need to understand the problems they are facing,

namely by writing down what is known and asked in the question, to facilitate the next steps in solving the problem (Rahmawati, R., Azizah, 2018).

Alternative learning approaches are required to engage kids in arithmetic, increase reflective thinking, and boost literacy. Teachers may use the inquiry learning paradigm to develop reflective thinking and literacy in mathematics. Searching and finding are key to inquiry learning. (Dawa, 2021) Inquiry learning emphasizes critical and analytical thinking to solve an issue. To educate students how to think, inquiry-based education was established (Saputra, 2016).

According to (Sugiyono, 2015), the inquiry learning paradigm requires students to think deliberately, analogically, and methodically to solve issues. So pupils must learn actively. (Purwanti, R. D., Pratiwi, D. D., & Rinaldi, 2017) defines inquiry learning as learning in which students plan investigations, make observations, analyze and interpret data, propose answers, form conclusions, and communicate.

The background description above shows that reflective thinking and literacy abilities are crucial to issue resolution. Students with critical thinking and reading abilities are anticipated to be the nation's future generation, ready to handle science and technology. The inquiry learning paradigm may promote literacy and reflective thinking. Therefore, this study's title is Analysis of Errors in Reflective Thinking Skills and Literacy Skills in the Implementation of the Inquiry Learning Model at MTs Abata Al Washliyah".

B. Research Method

This type of research uses qualitative research (Moleong, 2017). This research was conducted at MTs Abata Al Washliyah in the 2024/2025 Academic Year, even semester, with a schedule coordinated with school activities. The reason for choosing this school is that there has never been and this type of research has been conducted at this school. The subjects in this study were students of class VIII-1 MTs Abata Al Washliyah in the 2024/2025 academic year, totaling 30 people. While the object of this study is the analysis of reflective thinking and literacy skills in problem solving through the application of learning models. The research instrument is a reflective thinking and literacy test (Sugiyono, 2018). The mechanism of this research is research planning, instrument testing, research implementation, data analysis and research results. Data Analysis Techniques include data reduction, data presentation, and drawing conclusions (Miles, B. M., Huberman, M. A., & Saldana, 2014).

C. Result and Discussion

Description of Students' Mathematical Reflective Thinking Ability Level

Description of students' mathematical reflective thinking ability is obtained based on each student's score based on the results of the students' mathematical reflective thinking ability test.

For this reason, all student answer sheets from the results of the students' mathematical reflective thinking ability test are collected to be checked and scored. Scoring for each student's answer is based on the scoring guidelines for mathematical reflective thinking ability, then the total score of each student is then found to determine its level, then it will be classified based on the scoring guidelines assessed based on the principles of validity, purpose, fairness, integration, comprehensiveness and continuity, systematic, criteria-based, accountable. The level of students' mathematical reflective thinking ability can be seen in Table 1.

Table 1. Summary of Results of Students' Level of Mathematical Reflective Thinking Ability

No	SKBRM Level	Number of Students	Percentage	Criteria
1	$0 \leq$ SKBRM < 65	10	33,3%	Low
2	$65 \leq$ SKBRM < 85	13	43,3%	Currently
3	$85 \leq$ SKBRM < 100	7	23,4%	Tall

Based on the results of the mathematical reflective thinking ability test of 30 students, the level of mathematical reflective thinking ability of students was obtained which was spread across three levels. Of the 30 students, it turned out that the level of mathematical reflective thinking ability in students with moderate abilities had the highest proportion and was followed by students with low abilities. The results of research by Zetriuslita (2016), stated that the results of the analysis of problem-posing task data from each research group produced showed that it tended to be low. When compared with the results of the study, the results of the mathematical reflective thinking ability test of 30 students at MTs Abata Al Washliyah were in the "moderate" criteria. So, the level of mathematical reflective thinking ability of students with 'low' abilities was 33.3% totaling 10 students, 'moderate' abilities were 43.3% totaling 13 students, and 'high' abilities were 23.4% totaling 7 students

Analysis of High Ability Students' Mathematical Reflective Thinking Ability Answers

Based on the answer sheet of the reflective thinking ability test results and considering the willingness of students to be interviewed, S-25 was selected as a student who was analyzed qualitatively from high-ability students. The following is an analysis of the results of the reflective thinking ability test of student S-25 for each question tested on the reflective thinking ability test.

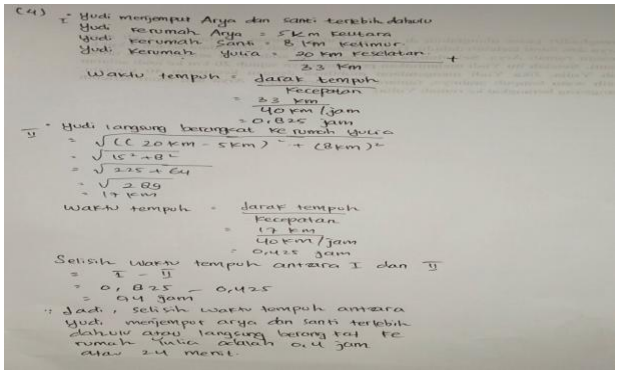

Figure 1. Analysis of High Ability Answers

Figure 1's S-25 response shows that students answer questions accurately. In the responding indication, students might indicate what is known and what is requested, and the link between the two. Also, focus on the second indication, elaborating. The student links the difficulty posed to the situation encountered to explain the solution. The final student response signal is pondering. The learner can discern the problem's purpose, fix and explain an inaccuracy, and draw proper inferences. In high-level reflective thinking in inquiry learning, students address issues in the responding, elaborating, and considering indicators.

Analysis of Answers to the Mathematical Reflective Thinking Ability of Medium Ability Students

Based on the answer sheet of the reflective thinking ability test results and considering the willingness of students to be interviewed, S-4 was selected as a student who was analyzed qualitatively from students with moderate abilities. The following is an analysis of the results of the reflective thinking ability test of S-4 students for each question tested on the reflective thinking ability test, then interviewed to see the errors in the students' mathematical reflective thinking process.

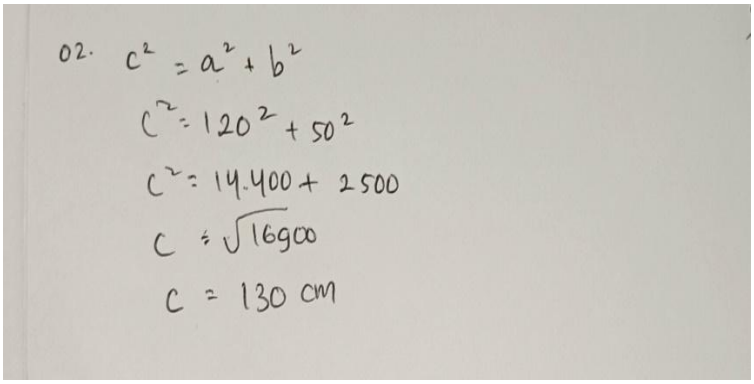

Figure 2 Medium Ability Answer Sheet

Figure 2 shows that students answer question number properly using S-4. Students do not work on questions according to the reflective thinking indication, as shown by the response. In the responding indicator, students do not mention what is known and what is requested. They also prioritize elaboration. The student links the difficulty posed to the situation encountered to

explain the solution. The final student response signal is pondering. The learner may discern the problem's aim, fix and explain any errors, but not draw a conclusion. After reflecting on their answers, moderate inquiry learners solve indications, elaborate, and contemplate.

Analysis of the Answers of the Reflective Thinking Ability of Low-Ability Students

Based on the answer sheets of the results of the reflective thinking ability test and considering the willingness of students to be interviewed, S-10 was selected as a student who was analyzed qualitatively from low-ability students. The following is an analysis of the results of the reflective thinking ability test of S-10 students for each question tested on the reflective thinking ability test, then interviewed to see the errors in the students' mathematical reflective thinking process

Data analysis of the results of students' reflective ability and mathematical literacy tests and interview results was carried out using data analysis steps according to Sugiyono (2016:247), namely "data collection, data reduction, data display, and drawing conclusions". Data analysis and research results obtained at each stage are presented as follows:

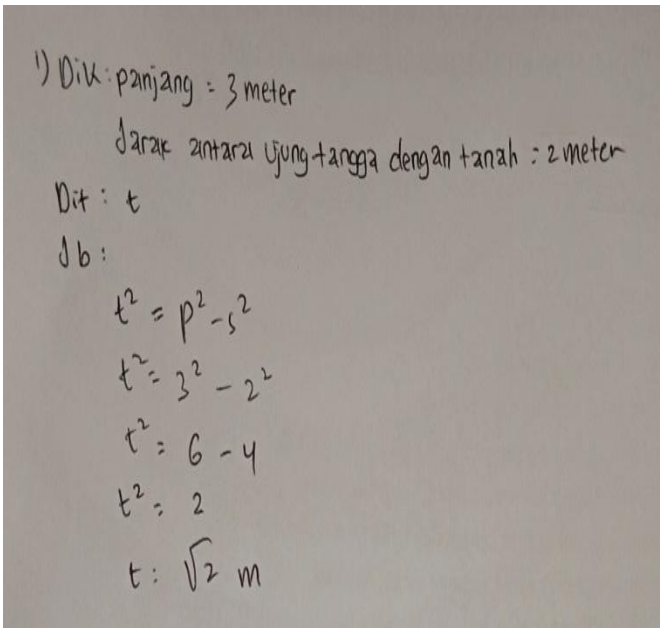

Figure 3. Low Ability Answer Sheet

Based on the answer S-10 in Figure 3, it can be seen that the student worked on question number 1. The student did not work on the question according to the reflective thinking indicator, namely from the answer it is described that only the reacting indicator is found in the answer S-10 where the student mentions what is known and what is asked. However, for the elaborating and contemplating indicators, they are not appropriate. It can be seen in the answer S-10, the workmanship is not quite right, so the final result is not correct.

Description of Students' Mathematical Literacy Ability Level

The description of students' mathematical literacy ability in mathematics is obtained based on the score of each student based on the results of the students' mathematical literacy ability test. For this reason, all student answer sheets from the results of the students' mathematical literacy ability test are collected to be checked and scored. Scoring for each student's answer is based on the reflective thinking ability scoring guidelines in mathematics, then the total score of each student is found later to determine its level, then it will be categorized based on the scoring guidelines assessed based on the principles of valid, objective, fair, integrated, comprehensive and continuous, systematic, criteria-based, accountable. The level of reflective thinking ability in students' mathematics can be seen in Table 2.

Table 2. Summary of Results of Students' Mathematical Literacy Ability Levels

No	SKLM Level	Number of Students	Percentage	Criteria
1	$0 \leq$ SKLM < 65	10	33,3%	Low
2	$65 \leq$ SKLM < 85	14	46,7%	Currently
3	$85 \leq$ SKLM < 100	6	20%	Tall

Based on the results of the mathematical literacy ability test of 30 students, the level of students' mathematical reflective thinking ability was obtained which was spread across three levels. Of the 30 students, it turned out that the level of mathematical literacy ability in students with moderate abilities had the highest proportion and was followed by students with very low abilities. The results of research by Wijayanto (2018), stated that the results of the analysis of problem-posing task data from each research group produced showed that they tended to be in the low group. When compared with the results of the study, the results of the mathematical literacy ability test of 30 students at MTs Abata Al Washliyah were in the 'moderate' criteria. So, the level of mathematical literacy ability of students with 'low' abilities was 33.3% totaling 10 students, 'moderate' abilities were 46.7% totaling 14 students, and 'high' abilities were 20% totaling 6 students.

Analysis of Mathematical Literacy Ability Answers of High-Ability Students

Based on the answer sheets of the literacy ability test results and considering the students' willingness to be interviewed, S-27 was selected as a student who was analyzed qualitatively from high-ability students. The following is an analysis of the results of the mathematical literacy ability test of S-27 students for each question tested on the mathematical literacy ability test.

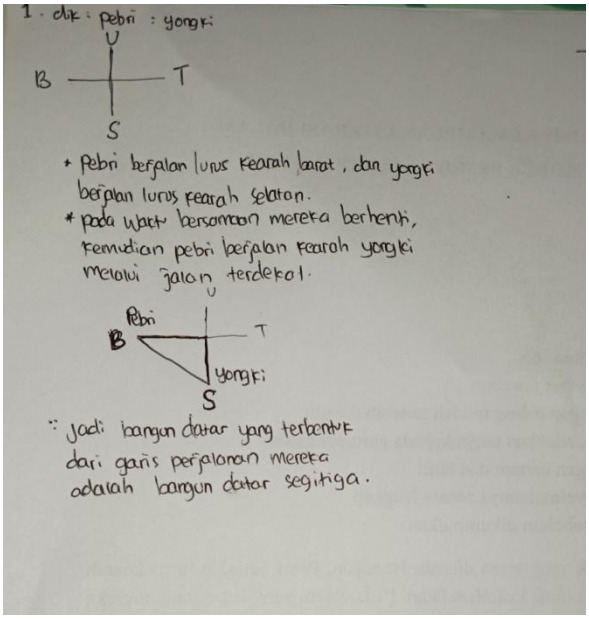

Figure 4. High Ability Answer Sheet

Based on the answer of S-27 in figure 4., it can be seen that the student worked on question number 1 very well and correctly. The student worked on the question according to the literacy ability indicator, namely being able to formulate problems mathematically. The student was able to explain the problems found in problem number one using their own understanding and simple language that is easy to understand. Furthermore, by paying attention to the second indicator, namely being able to use concepts, facts, procedures, and reasoning in mathematics. The student was able to use reasoning in the question, so that the student was able to make a picture of the cardinal directions. And the last indicator is interpreting mathematics to solve the problem. The student was also able to express the problem in number 1 into a triangle image, by understanding the meaning of the question.

Analysis of Mathematical Literacy Ability Answers of Medium-Ability Students

Based on the answer sheets of the mathematical literacy ability test results and considering the willingness of students to be interviewed, S-11 was selected as a student who was analyzed qualitatively from students with medium abilities. The following is an analysis of the results of the mathematical literacy ability test of S-11 students for each question tested on the mathematical literacy ability test, then interviewed to see the errors in the process of students' mathematical literacy abilities, then interviewed to see the errors in students' mathematical literacy abilities

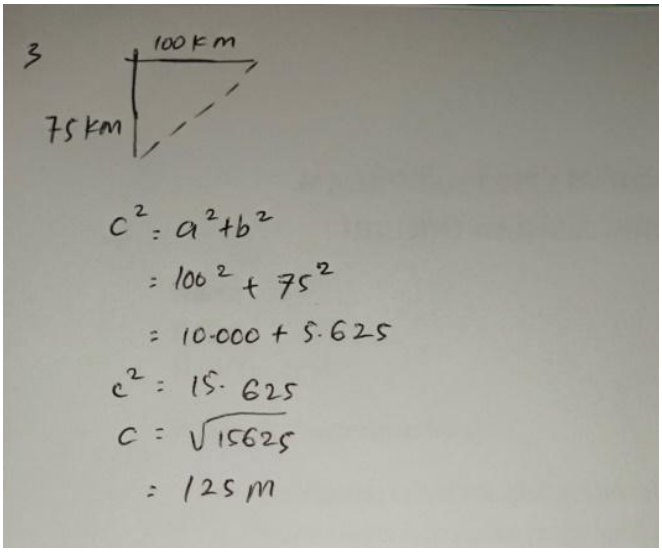

Figure 5. Medium Ability Answer Sheet

Based on the answer of S-11 in Figure 5, it can be seen that students do question number 3 well. Students do the questions according to the literacy ability indicator, namely being able to formulate problems mathematically. Students are able to explain the problems found in problem number three using their own understanding and simple language that is easy to understand. Furthermore, by paying attention to the second indicator, namely being able to use concepts, facts, procedures, and reasoning in mathematics. Students are able to use reasoning in the question, so that students are able to make a triangle image to help solve the answer. And the last indicator is interpreting mathematics to solve problems. Students are also able to express the problem in number 3 into a triangle image, by understanding the meaning of the question.

Analysis of Mathematical Literacy Ability Answers of Low-Ability Students

Based on the answer sheets of the mathematical literacy ability test results and considering the willingness of students to be interviewed, S-14 was selected as a student who was analyzed qualitatively from students with moderate abilities. The following is an analysis of the results of the mathematical literacy ability test of S-14 students for each question tested on the mathematical literacy ability test, then interviewed to see the errors in the process of students' mathematical literacy abilities, then interviewed to see the errors in students' mathematical literacy abilities

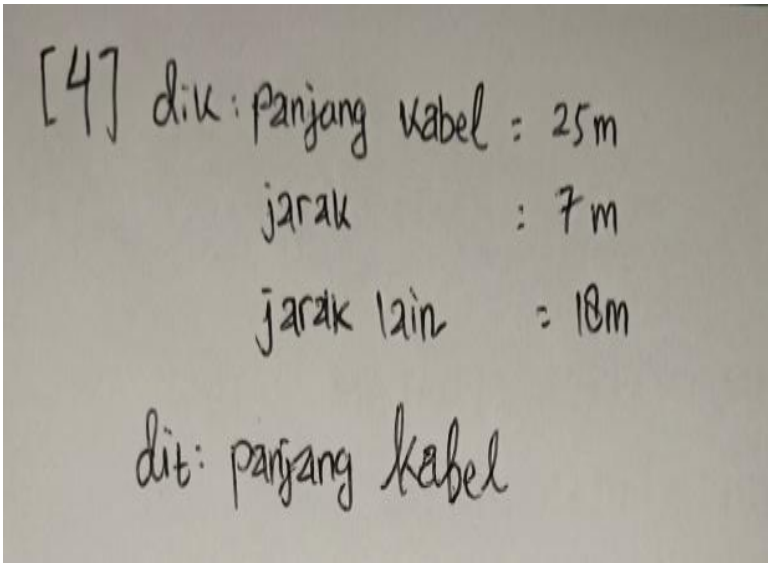

Figure 6. Low Ability Answer Sheet

Based on the answer of S-14 in Figure 6, it can be seen that students do not understand question number 4 so that the question is not worked on at all. Students do not work on questions according to the literacy ability indicator, namely being able to formulate problems mathematically. Students have not been able to explain the problems found in problem number three using their own understanding and simple language that is easy to understand. Furthermore, by paying attention to the second indicator, namely being able to use concepts, facts, procedures, and reasoning in mathematics. Students have not been able to use reasoning in question number 4 using their own understanding. And the last indicator is interpreting mathematics to solve problems. Students have also not been able to express the problems in number 4, so students are unable to solve the problem.

Discussion

In three sessions in class VIII MTs Abata Al Washliyah, student activity improved after the inquiry learning approach was applied, compared to traditional learning based on lectures or theories. Besides a student-centred learning paradigm, students require mathematical reflective thinking abilities, which may be developed via teacher-student interaction. The study's reflective thinking skills indications include 'high' interpretations for responding (96.43%), elaborating (85.3%), and considering (83%). In the moderate' level interpretation, responding is 88.5%, elaborating is 72.6%, and considering is 65.9%. The responding indication was 55%, the elaborating 41.9%, and the considering 32.5% in the 'low' level interpretation. This research indicated that 33.3% of 30 kids with 'poor' ability were 10; 43.3% were 13; and 23.4% were 7.

Students with more prominent reflective thinking skills are moderate' in this research. Students with modest mathematics literacy dominate. Also, just 7 pupils are good at reflective

thinking. Additionally, pupils' responses to the mathematics reflective thinking examinations as a whole are poor (Rizqiani, A. S., Sridana, N., Junaidi, J., & Kurniati, 2023). This is because kids are unfamiliar with mathematical reflective thinking problems. The study on mathematical literacy skills with high-level interpretations found that 97% of participants could formulate problems mathematically, 90.6% could use concepts, facts, procedures, and reasoning in mathematics, and 87.5% could interpret mathematics to solve problems. The medium level of interpretation showed 73.2% for being able to formulate mathematical problems and 66.5% for using concepts, facts, procedures, and reasoning in mathematics. The poor level of interpretation indicated 54.4% ability to construct mathematical issues, 40% ability to employ ideas, facts, methods, and reasoning in mathematics, and 39.4% ability to interpret mathematics to solve problems. The survey found that 33.3% of pupils had 'poor' mathematical literacy skills, 46.7% had medium' skills, and 20% had 'excellent' skills (Asrizal, 2018). Data triangulation was used to analyze reflective thinking process faults and student math literacy.

D. Conclusion

Based on the results of the analysis and discussion, the study concludes that students' responses reflect their thinking processes regarding the Pythagorean theorem material, as follows: In the high category, students solve problems on the reacting, elaborating, and contemplating indicators. In the medium category, students solve problems on the reacting and elaborating indicators. In the low category, students solve problems on the reacting indicator. The following outlines how students demonstrate their mathematical literacy skills regarding the Pythagorean theorem: In the high category, students solve problems on the indicator of being able to formulate problems systematically, being able to use concepts, facts, procedures, and reasoning in mathematics, and interpreting mathematics to solve problems. In the medium category, students solve problems on the indicator of being able to formulate problems mathematically and being able to use concepts, facts, procedures, and reasoning in mathematics. In the low category, students solve problems on the indicator of being able to formulate problems systematically. Errors in reflective thinking skills and literacy skills in the application of the inquiry learning model are as follows: In the high category, students do not make mistakes. In the medium category, students experience transformation errors and process skill errors. In the low category, students experience errors in understanding the questions, transformation errors, and process skill errors.

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