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Research Article

Mathematical connection skills of junior high school students in solving system of linear equations in two variables problems

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Abstract: Students mathematical connection skills are valuable dimension that teachers must put into consideration so that students can develop and link their mathematical skills with knowledge beyond Mathematics. This research aimed to analyze the mathematical connection skills of Junior High School students when solving the System of Linear Equations in Two Variables (*Sistem Persamaan Linear Dua Variabel*/SPLDV) problem. Students mathematical connection skills are valuable dimension that teachers must put into consideration so that students can develop and link their mathematical skills with knowledge beyond Mathematics. This research aims to analyze the mathematical connection skills of Junior High School students when solving the SPLDV problem. This research made use of Qualitative approach by which 18 students of grade VIII from SMP Argopuro 1 Panti Jember, East Java, participated. Mathematical connection skill test and interview guideline were conducted for this research. Data triangulation technique was used to process and compile data for the research report. The findings of the research discovered that students with high level of mathematical connection skills were able to relate and implement their knowledge to different kinds of situations, and students with medium level of mathematical connection skills were only able to apply their knowledge to simple situations, meanwhile students with low level of mathematical connection skills were unable to relate and implement their knowledge to a variety of situations.

Keywords: mathematical connection skills; problem solving; SPLDV

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1. Introduction

Mathematical connection skills play a very important role in mathematics learning activities (Baiduri et al., 2020), enabling students to connect mathematical concepts to the real world. Nuryanto and Yuliardi (2023) stated that the goals of mathematics learning are communication, connection, expression, reasoning, and proof. The higher the mathematical connection skills possessed by students, the more students will understand the material taught (Andriani & Aripin, 2019). According to Dayani and Hasanuddin (2020) they stated that the purpose of learning mathematics is to help students to be able to solve problems, strengthen memory, and improve their thinking skills, and train students to understand and connect their previous knowledge with new knowledge (Sukri et al., 2022).

Problem-solving skills are also no less important than mathematical connection skills, because if students are able to solve the problems in the questions, then automatically students are also able to see the relationships and connections given (Sintema & Mosimege, 2023). According to Amelia et al (2021) there are several reasons why mathematical connection skills are very important to master, according to them mathematical connections are skills that need to be trained and improved so that students are able to master the subjects that students get when they study further, and also able to train and understand students about the usefulness of mathematics and increase students' understanding of mathematics more broadly (Rodríguez-Nieto & Alsina, 2022). In addition Alfiana (2023) said that mathematical connection skills cover the relationship between mathematics internally and externally. Students are trained to link concepts in mathematics, both new and previously taught.

This means that students do not need to memorize the materials, but only understand the connections between concepts. Since each mathematics subject is related to each other, students' ability to make connections can help them understand the next subject (Nazaretha et al., 2019). Three indicators can be used to determine mathematical connections (Sumiati et al., 2021): the ability to relate concepts to mathematics, the ability to relate mathematics to other sciences, and the ability to relate concepts to everyday life.

In relation to the importance of students' mathematical connection skills, there have been a number of studies that discuss such as a research conducted by Nuryatin and Zanthy (2019) on the analysis of Junior High School students' mathematical connection skills in solving linear equations and inequalities with one variable. Another study was undergone by Nurafni and Pujiastuti (2019) on analysis of mathematical connection skills from the point of view of students' self-confidence, and research conducted by Imron (2020) in which focusing on students' mathematical connection skills in solving problems based on gender. On account of those previous studies, more in-depth research is needed to discuss how students' mathematical connection skills solve problems (Upara et al., 2024).

In addition to the significance of mathematical connection skills, Lestari et al (2016) said that efforts need to be made to overcome this by identifying students' mathematical connection skills based on their ability levels. In this study, the focus is on the importance of students' mathematical connection skills in solving SPLDV problems, mathematical connection skills here are divided into three levels, namely: (1) high mathematical connection skills in solving SPLDV problems; (2) moderate students' mathematical connection skills in solving SPLDV problems; and (3) low mathematical connection skills in solving SPLDV problems (Khadillah, 2022). To solve this problem, teachers and curriculum must create interesting mathematics learning methods that involve students (Julaeha et al., 2020). The goal is to involve students more actively in the lesson and do not simply rely on teachers to teach that only potentially lead them to boredom.

The purpose of this study was to analyze students' mathematical connection skills, identify students' obstacles in understanding mathematical connections, and provide recommendations regarding how to improve students' mathematical connection skills. Therefore, this research departs from three predetermined formulations, First, students' abilities in solving different kinds of problems by using the understanding they have already had. Second, the lack of student practices in solving problem-based and complex questions. Third, students' lack of understanding of the relationship between existing concepts and how to apply previous knowledge.

2. Materials and Methods

2.1 Types of research

The research use of descriptive method by employing qualitative approach. This method is a way to solve problems by illustrating the subject or object in the research according to the facts (Petronela et al., 2018). This method is in accordance with the purpose of the research, which is to evaluate the skills of Junior High School students in solving SPLDV problems using mathematical connections. SMP Argopuro 1 Panti, located on Jl. Lapangan No. 39 Panti, Jember became the place of research.

2.2 Research Subjects and Objects

The study was conducted in two days, from May 30 to June 11. The subjects of this research were students of class VIII B consisting of 18 students, with 9 students selected for further research on their mathematical connection abilities. To meet the needs of the study, a purposive sampling technique was used to select the subjects. The reasons for choosing the purposive sampling technique are: Selection of relevant samples, time efficiency, and data quality, and in accordance with the research objective.

2.3 Data Types and Sources

The Mathematical connection skill test and interview guide as tools to be used in this research. The questions consist of three essay questions, each covering mathematical

connection indicators: Students' skills in connecting different topics in mathematics, Students' skills in connecting mathematics with other field of study, Students' skills in connecting mathematics to everyday life. The mathematical connection indicators adopted in this research are presented and there are three indicators referring to Angelina and Effendi (2021), which include students' expertise in connecting different topics in mathematics subjects, linking mathematics with other fields of study, and linking mathematics with real context.

2.4 Data collection technique

Data triangulation techniques are used to process and organize data in research reports. This method involves collecting data through predetermined methods, namely mathematical connection skill tests, interviews with mathematics teachers, and interviews with students.

2.5 Data Analysis Techniques Data Analysis Techniques

Data analysis techniques according to Marissa et al (2024) used in this research are: Information reduction, information delivery, and drawing conclusions. The purpose of this technique is to obtain information. Table 1 depicts the classification of mathematical connection abilities. Students' mathematical connection skills are divided into high, medium, and low according to (Nathania et al., 2023). It can be seen from Table 1, students are classified into three level.

Table 1. Classification of Mathematical Connection Skills

Level	Assessment Benchmark
High	$X \geq \bar{x} + SD$
Medium	$\bar{x} - SD < X < \bar{x} + SD$
Low	$X \leq \bar{x} + SD$

Table 2 describes the benchmarks for scoring mathematical connection skills and students' answers based on Sumarno's opinion as quoted in Isnaeni et al (2019). Based on these guidelines, researchers can easily correct the answer results and determine the score that corresponds to the student's answers listed on the answer sheet.

Table 2. Mathematical Connection Scoring Benchmarks

Mathematical connection scoring benchmark	Score
Not answered	0
Result not accuratet	1
There are some results that are almost the same but the connection is not right	2
The answer is almost similar/matched, connection is almost right	3
The answer is right but the connection is incomplete	4
The answer is right and the connection is right	5

Mathematical connection skill test and interview guide as tools to be used in this research. The questions consist of three essay questions, each covering mathematical connection indicators. Data triangulation techniques are used to process and organize data in research reports. This method involves collecting data through predetermined methods, namely mathematical connection skill tests, interviews with mathematics teachers, and interviews with students. Data analysis techniques according to Marissa et al (2024) used in this research are: information reduction, information delivery, and drawing conclusions. The purpose of this technique is to obtain information

3. Results

3.1 Preliminary Research Phase

Identifying students' mathematical connection skills when solving SPLDV problems is the purpose of this research. The tool used is mathematical connection skills which are consisted of 3 essay questions, which include mathematical connection indicators. Looking at the test results, students are classified into three levels of mathematical connection skills: high, medium, and low.

Students with high level of mathematical connection skills are able to connect concepts and procedures in mathematics, such as connecting algebra to geometry or statistics to probability. They are able to apply these concepts to real-world situations or other areas of study, using prior knowledge to understand and solve new or complex problems. Students with moderate mathematical connection skills are able to partially connect some basic mathematical concepts, apply these concepts to simple real-world situations, and need assistance integrating prior knowledge with new material. Students with low mathematical connection skills are able to make limited connections with mathematical concepts, require intensive assistance to apply these concepts in real-world situations, and have difficulty connecting prior knowledge to new material without substantial assistance.

Table 3 indicates the classification of students' mathematical connection skills according to high, medium, and low levels which are arranged based on the results of the assessment of students' mathematical connection skills in solving SPLDV problems. Based on the data from the students' mathematical connection skills test in solving SPLDV problems based on the table above, the conclusion is that there are 4 students with high level of mathematical connection skills, reaching 22.2% of the total students. Then, there are 11 students with medium mathematical connection skills, reaching 61.2%. Meanwhile, there are 3 students with low mathematical connection skills, reaching 16.6% of the total students.

Table 3. Percentage of students' mathematical connection skills Level

Classification	Score Limit	Total student Number	Percentage
High	$X \geq 82.76$	4	22.2%
Medium	$17.24 < X < 82.76$	11	61.2%
Low	$X \leq 17.24$	3	16.6%
	Total	18	100%

In this study, the researcher opted 9 students as subjects based on the results of essay tests that included mathematical connection indicators in each question. The following table will present the results of subject selection based on the Mathematical Connection Ability test on the SPLDV materials. Each test question includes one mathematical connection indicator, three students were selected with high, medium, and low mathematical connection skills.

3.1 Student' mathematical connection skills on question number 1

Table 4 indicates the test results and categorization of mathematical connection skills of student number one. After selecting the subject on question number one, the researcher continued with the interview stage to validate the results of the student's answers. After explaining the attachment of student answers from each category along with the results of the interview. In the first indicator, students are required to understand the relationship between science and mathematics so that students are able to complete the test properly and correctly.

Table 4. List of Research Subject in Question Number one

Number	Student Code	Sex	Test Score	Classification Minimum Completeness Criteria
1.	STA	P	85	High
2.	SLV	P	55	Medium
3.	DS	P	30	Low

Based on Figure 1, students with high level of mathematical connection skills test number 1 demonstrated good skills in composing the known information, namely length = 3x width and perimeter of the field = 1000m². The students are also able to write questions, namely the area of the field. The next step, students make an analogy of length with x and width with y. Based on this information, students write the formula for the circumference of the field, substitute the formula, and find the result of the width of the field = 1250m². Students then determine the length of the field = 3l and use the rectangle formula to calculate the area of the field. The steps taken show that students are able to apply information in the problem, relate various mathematical concepts, and solve problems systematically and accurately.

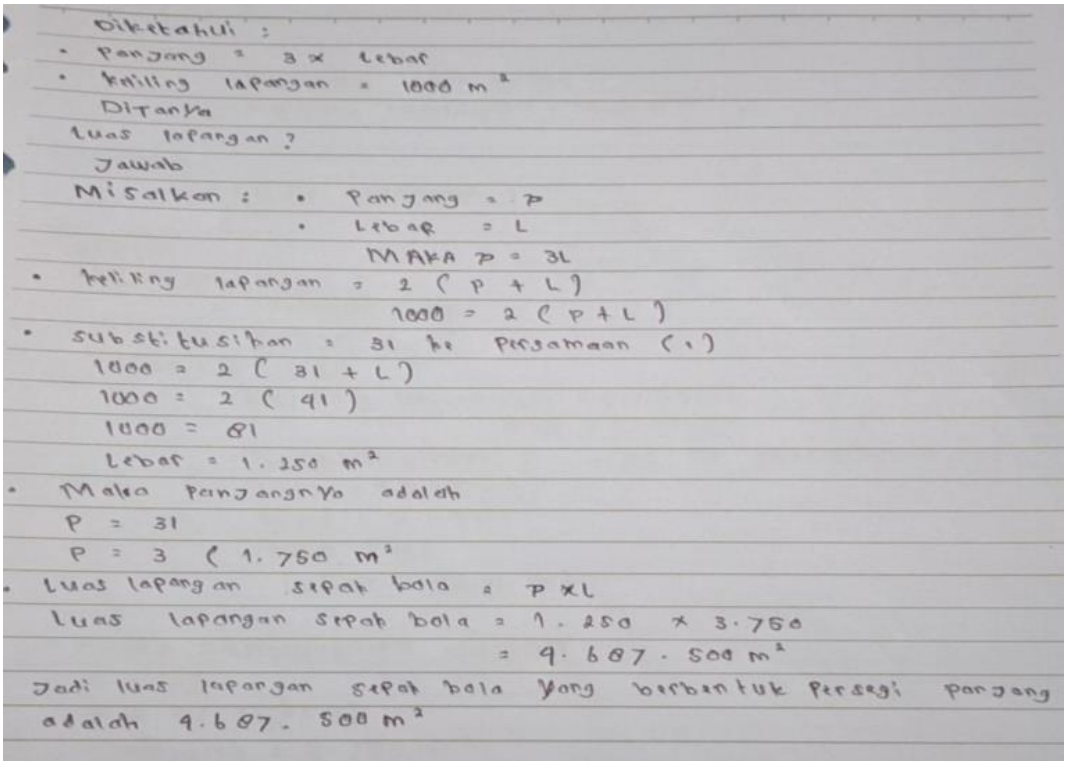

Figure 1. Demonstrates the category of students with high level of mathematical connection skills for question number 1

Following is the Interviews's citation between researcher (P) and (STA).

P: Do you have any difficulties when working on this question?

STA: No

P: What difficulties did you experience?

STA: No difficulties

P: How do you solve the problem in the questions?

STA: I ask teacher about questions i don't understand

P: Is this question related to other material in mathematics?

STA: Yes

P: If so, what material?

STA: The question asks about the area of the field, and the area of the field is related to the rectangle

P: Explain the process of working on the question in inches, starting from reading the question to writing the final result!

STA: 1. Write what is known

2. Write what is asked

3. Make an analogy, then calculate the circumference

4. Substitution

5. Calculate the area of a soccer field

Based on the researcher's interview with students with high level of mathematical connection skills in test number 1, students were able to explain their process when completing the problem, including writing the facts presented and asked, and arranging the method of working sequentially. Students were also able to answer questions about the relationship between the problem and other materials, such as the area and circumference of a rectangle. In explaining the steps for working on the problem, students were able to confirm correctly and exactly as written. Reviewed based on the results of the work and interviews, the conclusion is that students have high mathematical connection skills in connecting various mathematical concepts.

Figure 2 represents students with moderate mathematical connection skills, test number 1 shows good ability in writing formulaof field circumference, substituting the formula, and finding the result of the field width of 1250 m². Students also determine the length of the field as 3l. The steps taken indicate that students are able to implement the information in the problem and relate various mathematical concepts, but students have not reached the final stage of working on the problem.

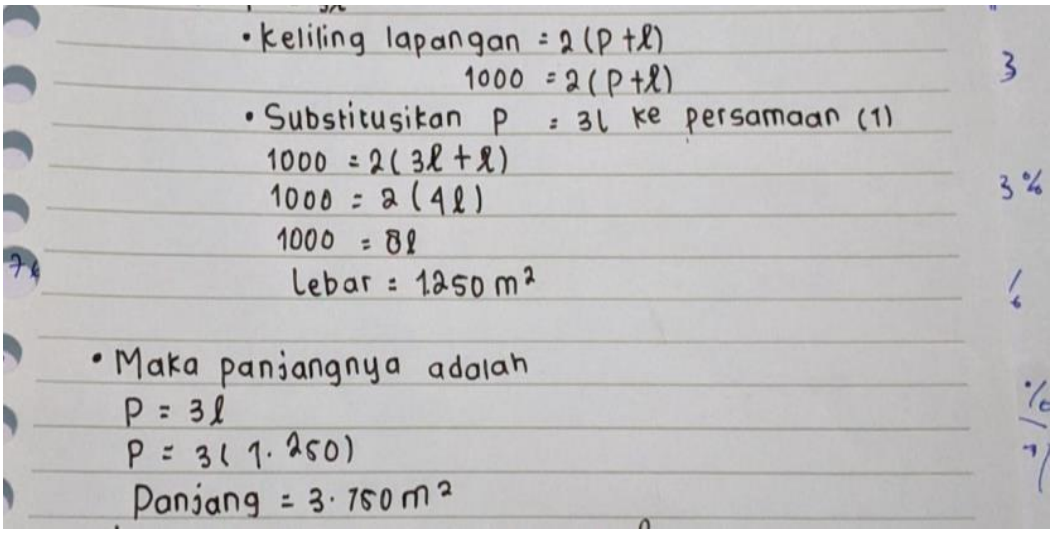

Figure 2. Demonstrates the category of students with high level of mathematical connection skills for question number 1

Following is the interview citation between researcher (P) and (SLV).

P: Did you have any difficulties when working on this question?

SLV: Yes

P: What difficulties did you experience?

SLV: making calculation

P: How did you solve the difficulties in the question?

SLV: Asking the teacher to explain the details of the question to calculate

P: Is this question related to other materials in mathematics

SLV: It seems so

P: If so, what subjects are related to this question?

SLV: It seems related to mathematics and science

P: Explain the process of working on the question in detail, from reading the question to writing the final result!

STA: At first I read the question carefully and started working by calculating until I found a certain answer

Based on the researcher's interview with students with medium level of mathematical connection skills on question no. 1, students were able to find the formulas provided, but had difficulty in making calculation. This difficulty affected the process of working on the questions, so that students were unable to complete them until the final stage. Students also seemed hesitant in linking various mathematical concepts, which had an impact on the process of working on the questions. Students explained that if there was something they did not understand, they would ask the teacher first, proving that students still needed teacher guidance when facing problems.

Based on Figure 3. Students with low level of mathematical connection skills doing test number 1 indicate the ability to write down the length equation through (p) and width through (l), calculate the circumference of the field well, but they are unable to continue working on the problem because they are unable to write down the information completely.

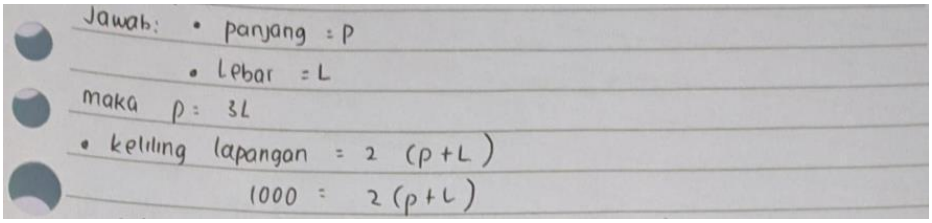

Figure 3. Shows the category of students with low mathematical connection skills for question number 1.

This leads to students unable to complete the questions up to completion.

The citationof the interview between researchers (P) and (DS) as follow:

P: Did you have any difficulties when working on this question?

DS: Yes

P: What difficulties did you experience?

DS: I don't understand the meaning of the question

P: How do you solve the difficulties in the question?

DS: I ask the teacher and friends

P: Is this question related to other material in mathematics

DS: no

P: If so, what subjects are related to this question?

DS: none

P: Explain the process of working on the question in detail, starting from reading the question to writing the final result!

DS: I write what is known

Based on the researcher's interview with students with low level of mathematical connection skills in test number 1, students were able to describe the formula presented, but had difficulty understanding the meaning of the question. This difficulty affected the process of working on the question, so that students were unable to complete it until the final stage. Students were also unable to link various mathematical concepts, which had an impact on the process of working on the question. Students explained that if there was something they did not understand, they would ask the teacher and ask for guidance from the teacher. In this case, it shows that students need intensive teacher direction when solving problems.

3.2 The students' mathematical connection advantage in question number 2

Table 5 depicts the test scores and categorization of students' mathematical connection skills on question number two. After selecting the subject on question number two, the researcher continued with the interview stage to validate the results of the students' answers. The following will explain the results of the students' answers from each category along with the results of the interviews. In the second indicator, students must have knowledge of other subjects beside mathematics, namely science.

Table 5. List of Research Subjects in Question Number Two

Number	Student Code	Sex	Test Score	Classification Minimum Completeness Criteria
1.	MRA	L	85	High
2.	MAR	L	55	Medium
3.	RIH	P	30	Low

Based on Figure 4. Students with high level of mathematical connection skills test number 2 illustrate good skills when writing down the known information. The next step, students assume distance with x and time with t. Based on this information, students write the formula for distance with speed x time. Students then determine the first speed of 60 km/h and the second speed of 72 km/h. The last step, students substitute the known speed to get the final result. These steps show that students are able to apply information in the problem, relate various mathematical concepts, and solve problems systematically and accurately.

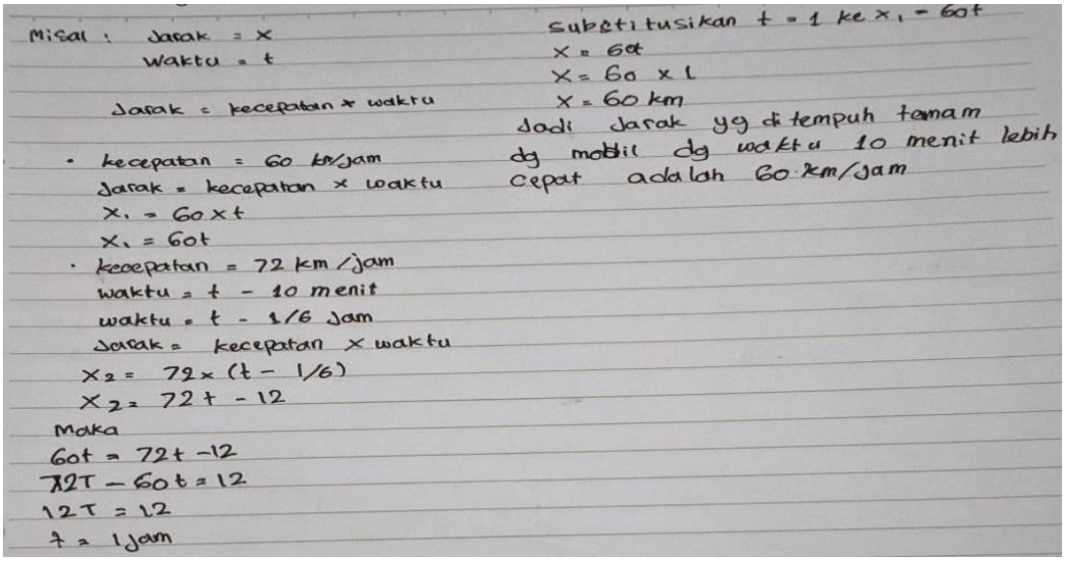

Figure 4. Shows the category of students with high level of mathematical connection skills for question number 2.

The result of the interview's citation between the researcher (P) and (MRA).

P: Did you have any difficulties when working on this question?

MRA: No

P: What difficulties did you experience?

MRA: No difficulties because I''ve already understood

P: How did you solve the difficulties in the question?

MRA: By asking the teacher

P: Is this question related to subjects other than mathematics?

MRA: Yes

P: If yes, Name the subjects that are related to this question?

MRA: Science

P: Explain the process of working on the question in detail, starting from reading the question to writing the final result!

MRA: 1. Determining the distance formula 1

2. Knowing the distance 1

3. Determining the distance formula 2

4. Knowing the distance 2

5. Determining the result

Based on the interview between researchers and students with high level of mathematical connection skills in test number 2, students were able to present the methods used when working on questions, including writing down known information and arranging the steps of the work in sequence. Students were also able to answer questions about the relationship of the questions to other subjects, such as science. In explaining the steps of working on the questions, students explained their intentions precisely and in line with what they wrote on the answer sheet. Based on the results of the work and interviews, the conclusion is that students who have high level of mathematical connection skills are able to combine various mathematical concepts with subjects outside of mathematics.

Based on Figure 5, students with medium level of mathematical connection skills in test number 2 demonstrate good abilities in writing distance formulas, namely speed x time, and determining the first and second distances. The steps taken show that students are able to apply information in the problem and relate mathematical concepts to other subjects, but they are unable to complete the problem until the final stage.

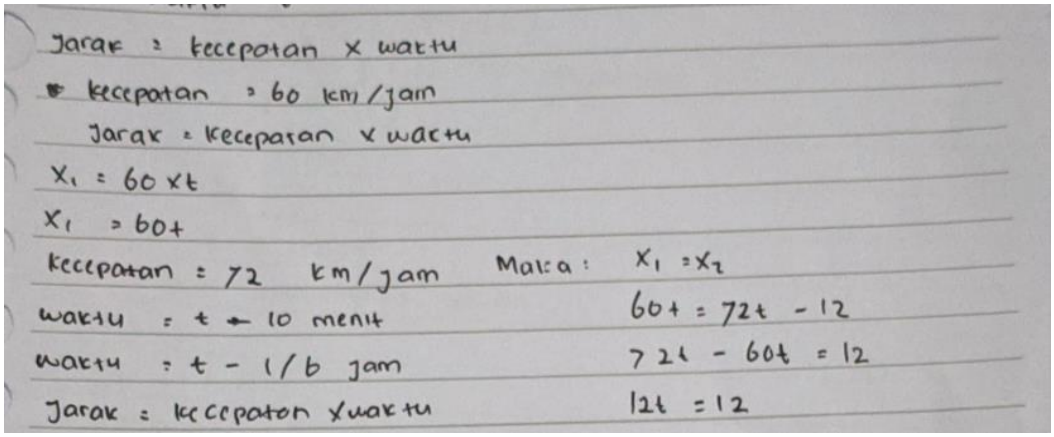

Figure 5. Shows the category of students with medium mathematical connection skills for question number 2.

The results of the interview citation between the researcher (P) and (MAR).

P: Did you have any difficulties when working on this question?

MAR: Yes, little bit difficult

P: What difficulties did you experience?

MAR: Difficulty in understanding questions that were not easy to understand

P: How did you solve the difficulties in the question?

MAR: By asking

P: Is this question related to other subjects?

MAR: Yes, science

P: If so, what subjects are involved in this question?

MAR: Yes, because it uses calculations to determine the results

P: Explain the process of working on the question in detail, starting from reading the question to writing the final resul

MAR: 1. Determine the distance formula 1

2. determine the distance 1

3. Determine the distance formula

4. Determine the distance 2

Based on the researcher's interview with students with medium level of mathematical connection skills number 2, students were able to describe the methods they know, but had difficulty understanding the purpose of the test. This obstacle affected the process of working on the questions, so that students were unable to complete them until the final stage. Students were also able to relate mathematical concepts to other subjects. They explained that if there was something they did not understand, they would ask the teacher first, illustrating that students needed the guidance of teachers in dealing with problems.

Based on Figure 6, students with low level of mathematical connection skills in test number 2 demonstrated sufficient ability in making analogies, but they were unable to continue working on the problem because they did not write down the information completely. This led them to be unable to complete the problem until the final stage.

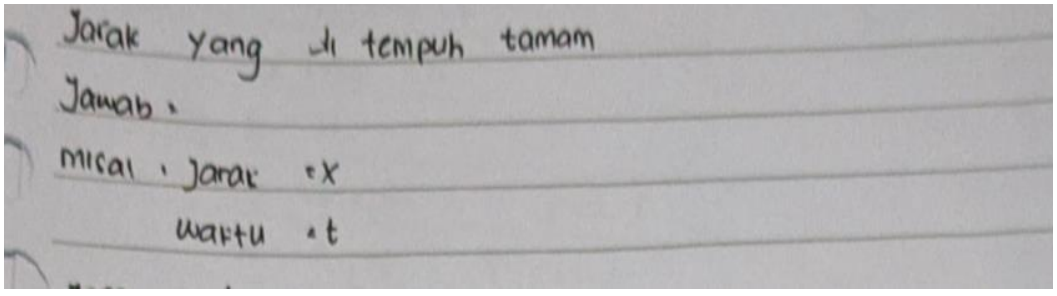

Figure 6. indicates the category of students with low level of mathematical connection skills in solving problem number 2.

Citation from the interview between researcher (P) and (RIH).

P: Did you have any difficulties when working on this question?

RIH: Yes

P: What difficulties did you experience?

RIH: I didn't understand the meaning of the question

P: How did you solve the difficulties in the question?

RIH: by asking the teacher

P: Is this question related to other subjects?

RIH: No, only mathematics

P: If so, what subjects are related to this question?

RIH: None
P: Explain the process of working on the question in detail, starting from reading the question to writing the final result!
RIH: Write what is know

Based on the researcher's interview with students with low level of mathematical connection skills in test number 2, students were able to extract information that was known, but had difficulty understanding the meaning of the problem. This difficulty affected the work process so that students were unable to complete it to the end. Students were also unable to link various mathematical concepts, which had an impact on working on the problem. They said that if there was something they did not understand, they would ask the teacher and ask for guidance. In this case, it proves that students need intensive teacher assistance when solving problems.

3.3 Students' Mathematical connection skills on question no. 3

Table 6 presents the test results and categorization of students' mathematical connection skills on question number three. After selecting the subject on question number three, the researcher continued with the interview stage to validate the results of the students' answers. Next, the results of the students' answers from each category will be presented along with the results of the interviews. In the third indicator, students must have knowledge about the relationship between mathematics and the real world context.

Table 6. List of Research Subjects for Question Number Three

Number	Student Code	Sex	Test Score	Classification Minimum Completeness Criteria
1.	TCD	P	85	High
2.	MYR	L	55	Medium
3.	SNF	P	30	Low

Based on Figure 7, students with high level of mathematical connection skills in test number 3 demonstrated good ability in describing known and asked information. They made an analogy of Tamam as *X* and Tiya as *T*, calculated the age of Tamam and Tiya 5 years ago and 15 years later, and used the elimination method to determine one of Tamam's or Tiya's ages. The last step is to substitute one of the known ages to get the final result.

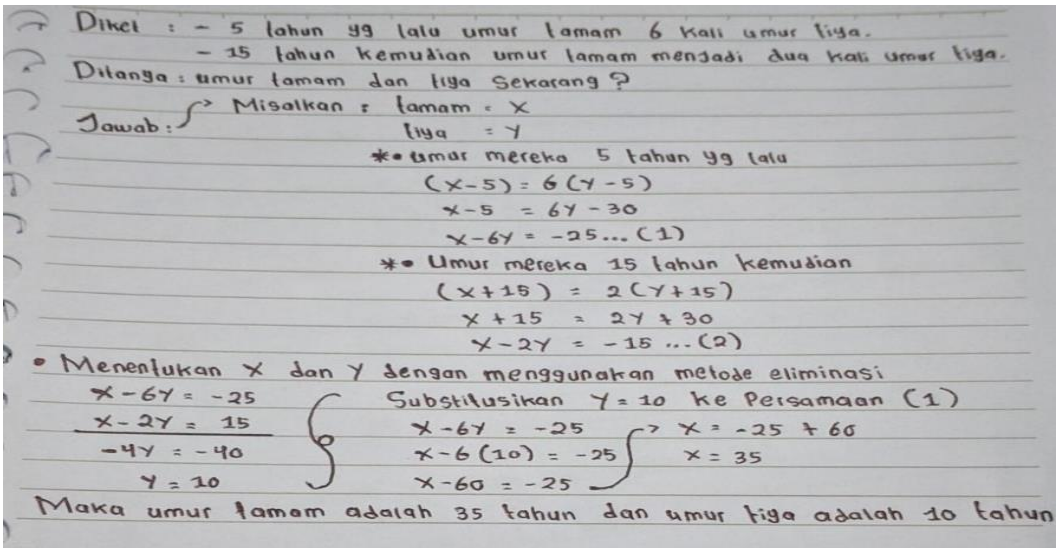

Figure 7. Indicates the category of students with high level of mathematical

Citation from the interview between researcher (P) and (TCR).

P: Did you have any difficulties when working on this question?

TCR: No

P: What difficulties did you experience?

TCR: No difficulties

P: How did you solve the difficulties in the question?

TCR: Asking questions that i don't understand to the teacher and others

P: Is this question related to everyday life?

TCR: Yes

Q: If yes, how is this problem related to everyday life?

TCR: Because question number 3 is related to asking someone's age

P: Explain the process of working on the question in inches, starting from reading the question to writing the final result!

TCR: 1. Determine what is known

2. Finding the age 5 years ago

3. Finding the age 15 years ago

4. Determining X and Y using the elimination method

5. Using the substitution method

6. Determine the results of the ages of Tamam and Tiya

Based on the researcher's interview with students with high level of mathematical connection skills on question number 3, students can explain the steps of working on the problem sequentially, answer questions about the relationship of the problem to everyday life and deliver explanations correctly according to what they wrote. Based on the results of the work and interviews, students with high level of mathematical connection skills when implementing mathematical concepts to real-world contexts.

Based on Figure 8, students with medium level of mathematical connection skills in test number 3 demonstrated good abilities in making analogies between Tamam as X and Tiya as Y, as well as determining their ages 5 years ago and 15 years later. Students were able to calculate the ages of Tamam and Tiya using the elimination method, but one step was missing, namely the substitution method, to find out their complete ages, so they were unable to complete the problem to the final stage.

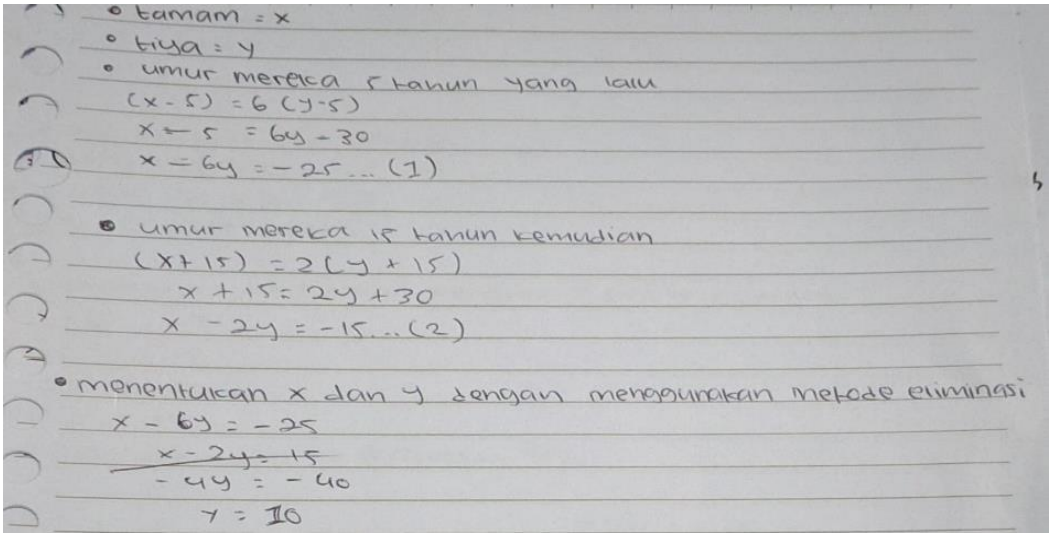

Figure 8. demonstrates the category of students with high level of mathematical connection skills for question number 3.

The Interviews citation between researcher (P) and (MYR).

P: Did you have any difficulties when working on this question?

MYR: Yes, a little difficulty understanding how to work on the question

P: What difficulties did you experience?

MYR: Understanding the formula

P: How did you solve the difficulties in the question?

MYR: by asking questions that i didn't understand

P: Is this question related to a real-world context?

MYR: No

P: If so, why is this question related to a real-world context?

MYR: Not related

P: Explain the process of working on the question in detail, from reading the question to writing the final result!

MYR: Writing the formulas and then writing them down to the last question!

Based on the researcher's interview with students of mathematical connection skills during test number 3, students were able to describe the known formula but students faced obstacles when digesting what was meant by the question. This obstacle affected the process of working on the question so that it was not completed. Students were also able to combine mathematical concepts in real-world contexts and explain that if there was something they did not understand they would ask the teacher first. In this case, it proves that students still need guidance from educators when solving problems.

Based on Figure 9, students with low level of mathematical connection skills in test number 3 demonstrated sufficient ability in making analogies. However, they could not continue working on the problem because they were unable to write down the information completely, so they could not complete the problem to the end.

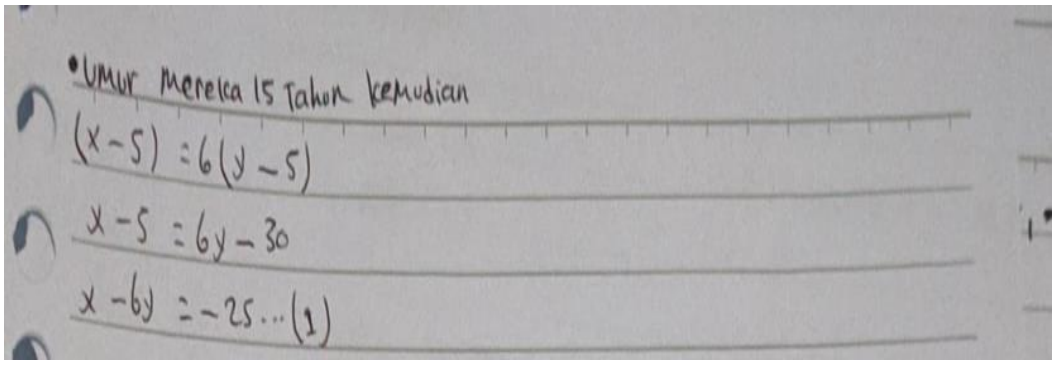

Figure 9. demonstrates the category of students with low level of mathematical connection skills for question number 3.

The interview's citation from researcher (P) with (NSF).

P: Did you have any difficulties while working on this question?

NSF: Yes

P: What obstacles did you encounter?

NSF: While working on it

P: How did you solve the difficulties in the question?

NSF: By asking then making calculation

P: Is this question related to a real-world context?

NSF: No

P: If so, why is this question related to a real-world context?

NSF: Not related

P: Explain the process of working on the question in detail, from reading the question to writing the final result!

NSF: at first I read it and answer it and then write it

Based on the researcher's interview with students with low level of mathematical connection skills in test number 3, students were able to describe what, but students experienced obstacles when solving the problem. The obstacles experienced by students affected the steps of solving, so that students were unable to complete the problem to the end. Students were also unable to connect mathematical concepts with real-world contexts, which had an impact on the work process. Students explained that if there was something they did not understand, they would ask the teacher and ask for guidance. In this case, it proves that intensive teacher assistance is needed in solving problems.

4. Discussion

Based on the results of the analysis, it can be said that students' mathematical connection skills in solving SPLDV problems encounter some obstacles in linking mathematics with other fields outside of mathematics. Improving students' mathematical connection skills is the background in this case. The findings of this research are in line with research conducted by Isnaeni et al (2019) in which proves that mathematical connections help students to combine advanced and integrative interpretations. In addition, research conducted by Nazaretha et al (2019) emphasizes the importance of connection skills in building a bridge between isolated knowledge and holistic understanding. Based on data analysis, the findings of this study show variations in students' mathematical connection skills in solving SPLDV problems. Students' mathematical connection abilities begin through several stages, namely: students are able to understand the meaning of the question, students are able to see whether or not there is a connection in the question, students are able to complete and sequence the solution, students are able to draw conclusions regarding the connections in the question (Maphutha et al., 2023). The following are findings based on each mathematical connection indicator:

This study aims to identify students' mathematical connection abilities in solving SPLDV problems, students' mathematical connection abilities occur when students are able to associate and see the relationship between several concepts in mathematics (Maphutha et al., 2023). The following are the findings based on each mathematical connection indicator: First, how are the mathematical connection abilities of high-ability students in solving SPLD problems, Second, how are the mathematical connection abilities of medium-ability students in solving SPLDV problems, Third, how are the mathematical connection abilities of low-ability students in solving SPLDV problems. The following will present the findings of this study:

Students with high level of mathematical connection skills in bridging the concepts between mathematics are able to connect mathematical concepts between topics, students have sufficient connection skills in identifying the relationship between SPLDV concepts and other topics such as finding the area and circumference of flat shapes. For example, students with high abilities can explain how the solution to SPLDV can be identified through the substitution method. This research is consistent with the results of a research conducted by Sappaile et al (2024) which emphasizes the importance of linking various mathematical concepts to strengthen student understanding, This proves that high mathematical connection skills in connecting concepts in mathematics can make it easy for students to apply their knowledge correct l (Rafiepour & Faramarzpour, 2023). Because students who have good mathematical connection skills tend to understand subjects more deeply and comprehensively, and can connect mathematical concepts well and systematically and also in-sync with the knowledge they have gained.

Students with medium level of mathematical connection skills in combining concepts between mathematics, students can connect several concepts in mathematics, but still need help to understand more complex relationships, they can describe what information is contained in the question and what is asked, but they are unable to solve the problem, this is because students are still hesitant to see whether there is a connection between topics in mathematics (Net et al., 2023). In this case, it is in line with the findings of Nurul Imam (2023) which states that students are able to solve problems correctly if they are able to combine concepts between sciences in mathematics subjects. This situation has proven that students' lack of understanding and doubts in understanding the material are factors that influence students' understanding of the connections contained in the questions (Quilang & Lazaro, 2022). Students with moderate mathematical connection skills show adequate ability in connecting SPLDV with other basic concepts. However, they still need guidance to see deeper relationships between topics and how to apply them more broadly.

Students with low level of mathematical connection skills in bridging concepts between mathematics, students have difficulty seeing the correlation between concepts in mathematics, students tend to use a limited approach. In this case, it is in line with the findings of Nurafni and Pujiastuti (2019) which state that students who have low connection skills tend to have difficulty formulating what is known in the problem. So this situation is in accordance with research conducted Foster and Lee (2021) students with low connection skills often face obstacles when connecting SPLDV with other mathematical concepts. They need intensive guidance to understand the relationship between topics and how these concepts can be applied together.

Students who have high level of mathematical connection skills in applying mathematical concepts to other materials, students are able to apply mathematical concepts to other subjects, students are also able to apply the SPLDV concept in solving problems that are related to other materials (science), such as speed problems. For example, they can use SPLDV to solve problems in acceleration that require their knowledge of the speed formula. This finding is supported by a study of Mone et al (2022), which shows that the ability to apply concepts in mathematics to subjects other than mathematics is an important indicator of deep mathematical understanding. Students' mathematical connection skills in linking mathematics to other subjects can develop students' knowledge, skills, understanding, and awareness of the relationship between mathematics and materials other than mathematics (Campo-Meneses et al., 2021). This can be improved by using more innovative and creative learning methods to develop students' sensitivity and connection skills when connecting mathematics to sciences other than mathematic.

Students with medium level of mathematical connection skills in applying mathematical concepts to other materials are sometimes able to relate concepts to subjects other than mathematics (Rachmawati et al., 2019), but are inconsistent and require more practice. Students with medium abilities can relate SPLDV to several real situations, but cannot complete the problem to the final stage. This finding is in line with Aliyah et al (2019) who said that students with medium abilities can write the relationship between mathematics and sciences other than mathematics, but cannot work on problems to the final stage. They need more examples and practice to develop this ability more regularly and deeply.

Students with low level of mathematical connection skills in applying mathematical concepts to subjects other than mathematics, students have difficulty linking mathematical concepts to real situations, and often do not see the relevance of mathematics to material beyond mathematics. This is in line with the findings of Aini et al (2016) which state that if students are unable to apply connections in mathematics to contexts other than mathematics, then they will not be able to solve problems to the completion stage. Students with low abilities have difficulty linking SPLDV to materials other than mathematics and require significant support to develop an understanding of the practical applications of mathematics. They often do not see the relevance of mathematical concepts to other subjects.

Students with high level of mathematical connection skills in implementing mathematical concepts with real-world contexts, students are able to involve mathematical

concepts with real-world contexts, some students are able to relate SPLDV problems to real situations, such as the use of SPLDV in determining a person's age. However, there are still students who face obstacles when applying this concept to everyday contexts, which indicates the need for stronger contextual learning. Research by Andriani and Aripin (2019) supports this finding, which states that in order to increase students' skills in combining mathematics with real life, students must be able to master the mathematical concepts they already have. With this, learning in schools must be emphasized on practicing students to be able to use their knowledge in real situations (Baiduri et al., 2020), for example learning that involves students' daily activities, can be related to the concept of buying and selling, the concept of calculating age, or other concepts in mathematics that can increase students' skills in understanding the relationship between mathematics and their real lives.

Students with medium level of mathematical connection skills are good at implementing mathematical concepts in real-world contexts, students are able to apply concepts in several new contexts, but tend to have difficulty with very different or complex situations. Students with medium abilities can apply SPLDV in everyday life, but they tend to have difficulty when faced with very different or complex situations. This is in line with the findings of Amelia et al (2021) which state that if students are able to write what is meant in the problem but they have not been able to relate mathematical concepts to real contexts, this is because they do not understand the meaning and what is ordered in the problem. They need additional guidance to understand how to apply these concepts in various new situations.

Students with low level of mathematical connection skills in implementing mathematical concepts in real-world contexts, students have difficulty applying mathematical concepts to real-world contexts, and require highly structured guidance. In this case, it is similar to research conducted by Hasanah et al (2018) which states that the main obstacle for students in being able to implement mathematics with daily activities is their lack of understanding of the meaning contained in the problem (Son, 2022). They require highly structured guidance and are often unsure how to apply their mathematical knowledge in different situations.

5. Conclusions

Mathematical connection skills are very important and useful for the continuity of mathematics learning in subsequent materials. Based on what was obtained, the findings in this study are: Students with high mathematical connection skills in each indicator are able to apply their knowledge, apply it in solving complex problems and are able to solve the problems presented with complete and detailed work methods. Students with medium mathematical connection skills in each indicator are able to apply the knowledge they obtain and can solve the problems given, but they cannot apply their knowledge to a complex problem, their abilities are only limited to the scope of solving simple problems Students with low level of mathematical connection skills in each indicator cannot see whether there is a relationship between the concepts presented, causing them to be unable to complete the problems given, whether they are complex problems or simple problems. So, to overcome the obstacles experienced by students in connecting and applying their knowledge, teachers need to prepare and design models and methods used in learning. Hence, it can stimulate students' knowledge in linking concepts in mathematics or outside mathematics, and it is crucial to familiarize students to work on problem-based questions with the aim of familiarizing students to developing their connection skills.

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