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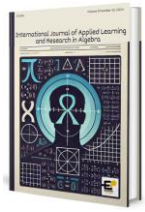

Exploring Middle School Students' Mathematical Connection Skills in Solving Systems of Linear Equations

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Abstract

This study aims to analyze the ability of mathematical connections in solving concept problems between mathematics, mathematical concepts, and other studies, as well as the ability to connect mathematical concepts to solve problems in everyday life. This research method is descriptive qualitative. The subjects of this study were 36 students of class VIII SMP Negeri 1 Cipanas. The instruments used were test questions describing mathematical connections and interviews. The results of this study indicate that students who can connect concepts between Mathematics are 68% in the medium category, then for the ability to connect between Mathematical concepts with other studies is 63% in the medium category and for the ability to connect mathematical concepts to solve problems in everyday life. day is 81% with the High category. So it can be concluded that the percentage of mathematical connections at the VII grade junior high school level with SPLDV material is 70.6% in the high category.

Keywords: Mathematical ability, Mathematical connection, SPLDV

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1. Introduction

Mathematics is the queen of science commonly called the Queen of Science. Mathematics is a basic science that plays an important role in training students' skills in solving various problems

in everyday life. Students experience difficulty in learning mathematics with a higher level of difficulty if they do not understand mathematical concepts and mental knowledge are intricately linked, therefore, in order to tackle abstract mathematical issues, one must possess the requisite aptitude.

Gaining comprehension of the subject. Learning maths is inherently linked to comprehending concepts. Mathematical connection abilities refer to the capacity to establish links between different mathematical concepts. Mathematical connection abilities enable students to establish linkages between concepts, facilitating their application in various contexts and enhancing their overall significance. It is anticipated that this will cultivate pupils' enthusiasm for maths. Mathematical connection is a human capability that allows for the representation of internal and external linkages within mathematics. This includes the connections between mathematical concepts, connections with other academic disciplines, and connections in everyday life.

Mathematical connection refers to the concept of establishing relationships and associations between different mathematical ideas and concepts. This word was coined by the National Council of Teachers of Mathematics (NCTM) and has been widely adopted as a fundamental component of standard curriculum. Mathematical connection is the proficiency in comprehending concepts and their interrelationships when solving mathematical problems. It also involves understanding the connections between mathematical concepts and other academic disciplines. Proficiency in establishing mathematical connections is crucial for students, as it empowers them to resolve mathematical difficulties not just in other academic disciplines but also in their daily lives. (Angelina et al., 2021). According to (Naibaho et al., 2022), mathematical connection ability refers to students' aptitude for identifying relationships between concepts and procedures, comprehending connections among different mathematical topics, and applying mathematical concepts in various contexts, including everyday life. NCTM identifies three indicators of students' mathematical connection abilities within connection groups: 1) the connection between mathematical topics, 2) the connection with other sciences, and 3) the connection with the students' real-world and daily life experiences. The citation for this source is Isnaeni, S. et al, 2019.

Kiswanto Kenedi and colleagues, 2018) Mathematical connections are crucial for pupils since they enable them to establish links between different topics. Students comprehend mathematical concepts by virtue of their acquisition of preparatory knowledge that is applicable to real-life situations. Irrespective of students' ability to establish connections between the information they are studying and past topics or other subjects, the process of learning mathematics gains greater significance. This assertion is corroborated by other research that demonstrate a persistently low level of mathematical connection skills, necessitating their enhancement. The study conducted by Septian et al. (2020) categorises the level of mathematical connection abilities among vocational high school students in Cianjur for the 2019/2020 academic year into three groups. The categorisation of this data is derived from the outcomes of the mathematical aptitude test. The distribution of students' mathematical connection abilities in the topic of trigonometry at the vocational high school (SMK) level is as follows: two students in the high category, twelve students in the medium category, and fifteen students in the low category. This suggests that the majority of students at the SMK level have low mathematical connection abilities in trigonometry. The limited

mathematical connectivity exhibited by vocational high school students in trigonometry can be attributed to various common errors, such as conceptual misconceptions, computational deficiencies, and difficulties in interpreting mathematical language. This is consistent with the results of the study conducted by Nuryatin, S., & Zanthy, L. S. (2019). The capacity to establish connections between mathematical concepts, as demonstrated by students' replies in solving linear equations and inequalities in one variable, is evident. Students exhibit conceptual errors in questions pertaining to the interrelationships among mathematical themes, and in the application of mathematical principles in.

Furthermore, these concepts are applicable in several contexts, such as other academic subjects, real-life scenarios, and practical situations. Furthermore, there are pupils that commit conceptual and practical mistakes, specifically when faced with the same representation dilemma. Nugraha, A. A. (2018) stated that proficiency in mathematical problem-solving is heavily reliant on one's ability to establish connections between mathematical concepts. By acquiring these skills, students may comprehend mathematical problems with precision and thoroughness. During the connection ability exam administered by three students, only one student demonstrated a high level of mathematical connection, while the remaining two students exhibited an appropriate level of connection. The three students are facing difficulties in explaining their actions as they struggle to define the rationale behind each step of solution.

Given the aforementioned description, which emphasises the significance of mathematical connection skills and a review of several study findings indicating low levels of such connections, it is crucial to assess students' mathematical connection abilities. Consequently, researchers are intrigued by the investigation of the mathematical correlation skills of eighth-grade children. The peculiarity of this research lies in its focus on junior high school level students, the utilisation of a descriptive qualitative research method, and the application of the Two Variable Linear Equation System (SPLDV) as the research material. The selection of this material was based on its potential for generating a variety of essay questions pertaining to mathematical connections. Specifically, these questions would explore the correlation between SPLDV material and previously covered mathematical concepts, the interplay between SPLDV material and other scientific disciplines beyond mathematics, and the practical application of SPLDV material in everyday situations. The research is titled "Analysis of Middle School Students' Mathematical Connection Abilities on System of Linear Equations in Two Variables." Its objective is to investigate the mathematical connection abilities of class VII Middle School students on the topic of SPLDV at Cipanas 1 Public Middle School.

2. Methods

The research employed a descriptive qualitative methodology, as indicated by the study's findings (Fadli, 2021). Qualitative research involves conducting scientific investigations to identify and understand phenomena or facts and seeking solutions or answers to address problems. One of the reasons is that the knowledge obtained is rudimentary since it is derived from preexisting facts, events, and realities rather than intentionally developed by researchers. 2) The findings of extensive inquiry and thorough, concentrated deliberation due to the comprehensive study of the subject matter. The research was carried out at SMP Negeri 1 Cipanas. The participants of this study consisted of 36 students in the VIID class. The utilised

material consists of a set of linear equations involving two variables. This study employs assessment tools in the form of tests and interviews. Tests, as a means of evaluation, involve presenting pupils with written questions. Tests are commonly employed to evaluate and quantify students' cognitive learning achievements, particularly in relation to effectively handling educational information in alignment with learning goals (Angriani, A. D., Nursalam, N., Fuadah, N., and Baharuddin, B., 2018).

The test questions in this study align with the markers of mathematical connection ability as defined by the National Council of Teachers of Mathematics (NCTM). Three key aims of mathematical connection require emphasis in educational institutions. Firstly, broaden the students' intellectual boundaries. Secondly, it is important to perceive mathematics as a cohesive entity rather than as a separate subject. Furthermore, it is important to articulate the significance and advantages of the topic, both inside the educational setting and in other contexts. These objectives imply that mathematics is not only applicable to its own discipline, but also has practical applications in other fields and everyday life. The test questions, which assess mathematical connection skills, are presented in Table 1 along with the components they investigate.

Table 1 Mathematical connection indicator

Question Number	Mathematical Connection Indicator
1	Connecting concepts between Mathematics
2	Connecting Mathematics concepts with other studies
3	Connecting mathematical concepts to solving problems in everyday life

The questions used can be seen in Figure 1.

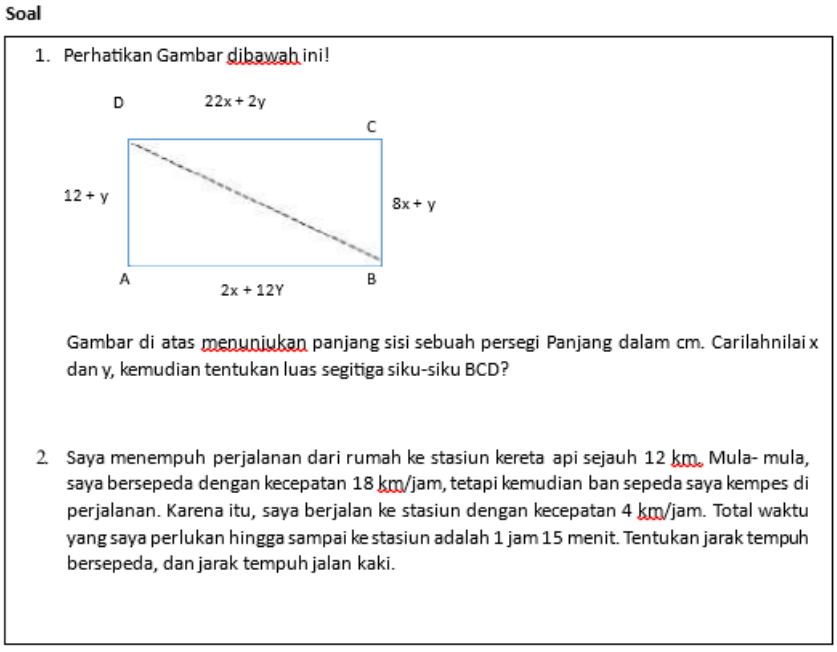


Figure 1 Test instrument questions

Data processing involves computing the proportion of each indication in relation to connection capacity. Student scores are divided based on their performance in a mathematical

connection ability test. The scoring of mathematical connection ability, as determined by the indicators utilised in this study, is presented in Table 2.

Tabel 2 - Mathematical connection indicator

Category	Mathematical connection indicator
4	A correct answer with the correct steps and correct reasons
3	The final answer is not precise due to a calculation error, but some steps and reasons show the correct connection of concepts/procedures
2	The final answer is incorrect/incorrect due to a calculation error, but some steps and reasons show the correct connection of concepts/procedures
1	There are answers, but there are no steps or reasons that show the relationship between the concepts/procedures.
0	No answer

In analyzing the test results, it is done by measuring the percentage of each indicator. X is the ability of each indicator, then,

$$X = \frac{P}{Q} \times 100\%$$

Information:
P = Total number of scores per indicator obtained by students
Q = Maximum number of scores per indicator

Furthermore, students' mathematical connection scores are classified into high, medium, and low categories, the criteria for students' mathematical connection ability groups are in Table 3.

Table 3 - Criteria for grouping mathematical connection ability

Category	Persentage (%)
High	$70 \leq X < 100$
Medium	$50 \leq X < 70$
Low	$0 \leq X < 50$

Modification of Isnaeni, Ansori, Akbar, & Bernard (2018)

Data collection in this study was also conducted through interviews. The purpose of the interview was to examine/trace the respondents' motives for answering the mathematical connection test. The ability to examine mathematical relationships is evidenced by the interpretation that the respondent answered questions during the interview. One thing that is considered in the mathematical connection interview in this study is objectivity. Objectivity refers to the relationship between the interviewer and the respondent. The interviewer gives the respondent the freedom to do anything related to the problem given. The goal is to minimize the influence of the interviewer on the subject. In addition, the interviewer helps the subject as little as possible in answering the problem explicitly or implicitly to direct it towards the answer desired by the interviewer, such as giving instructions or motivation that can influence the subject's thinking process.

3. Result and Discussion

3.1. Results

The results obtained after providing the instrument in the form of a test, the researcher obtained these results by using the percentage of the solution of the questions related to the connection ability indicators which can be seen in Table 5.

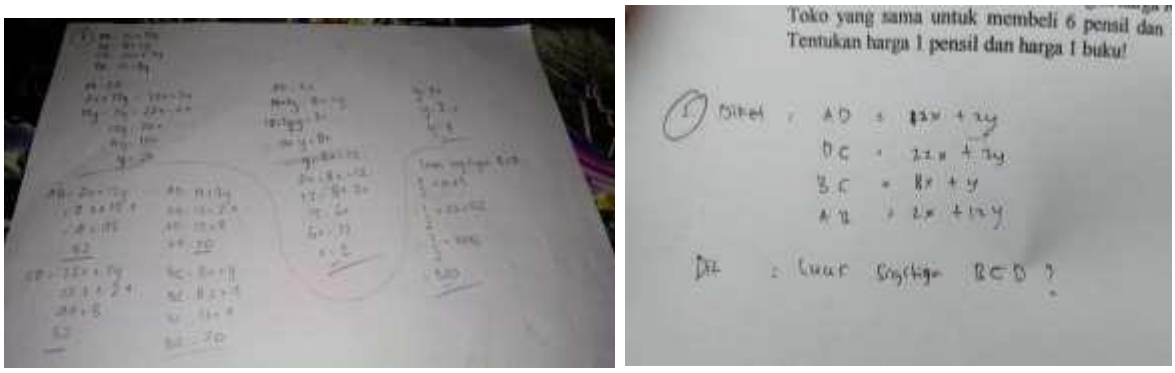
Table 4 - Results of mathematical connection ability

Question Number	Mathematical Connection Indicator	Percentage (%)	Category
1	Connecting concepts between mathematics	68	Medium
2	Connecting mathematics concepts with other studies	63	Medium
3	Connecting mathematical concepts to solving problems in everyday life	81	High

The aspect of the modified mathematical connection ability as a whole, obtained a percentage of 70.6% and is located in the High category from the results of the indicator connecting concepts between mathematics getting a percentage of 68% with the Medium category, the results of the indicator connecting concepts between mathematics and other studies getting a percentage of 63% with the Medium category, and the results of connecting mathematical concepts to solve problems in everyday life getting a percentage of 81% with the High category.

3.2. Discussion

Based on the results of the data analysis that has been obtained, the study of the mathematical connection ability of junior high school students in one of the schools in Cipanas, namely SMP Negeri 1 Cipanas, was conducted by solving the two-variable linear equation system (SPLDV) questions totaling 3 questions. Each of these questions contains indicators of mathematical connection ability. From these questions used to measure students' mathematical connection abilities, there are 36 subjects used in this study. To see the comparison of answers, some of them have good and poor mathematical connection abilities.

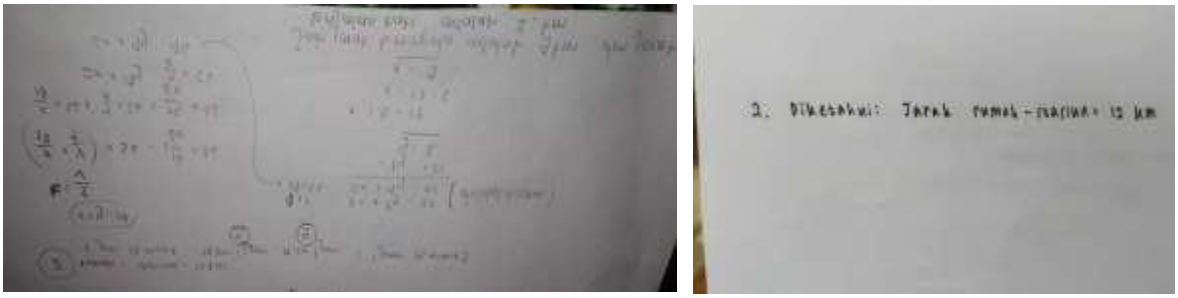


(a) (b)

Figure 2 Results of Students' answers to question no. 1 (a) Student A and (b) Student b

Figure 2 shows the results of student A and student B's answers which are the results of answering question number 1 with mathematical connection skills that connect concepts between Mathematics. Student A is a student who has a High category and Student B is a

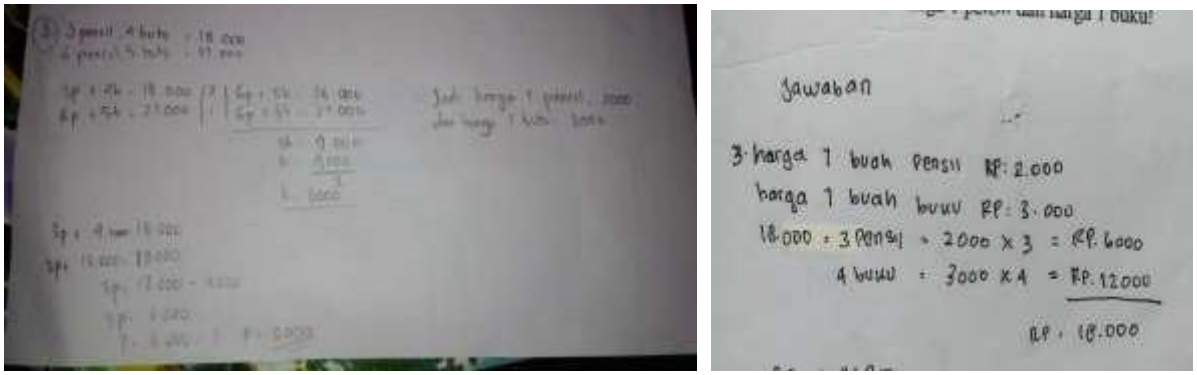
student who has a low category. Student A is categorized as High because the results of his answers are correct and appropriate and equipped with a work flow, from the results of the interview student A also understands the concept of SPLDV material and understands that the question has a connection with the flat shape material while Student B in working on the question only writes information from the question and is unable to work on it in the interview, student B does not understand the concept of SPLDV material.



(a) (b)

Figure 3 Results of Students' answers to question no. 2 (a) Student A and (b) Student b

Figure 3 shows the results of student A and student B's answers which are the results of answering question number 2 with mathematical connection abilities that connect mathematical concepts with other studies. Student A is categorized as High because the results of his answers are appropriate and equipped with the correct work flow, from the results of the interview, student A also stated that he had worked on the same case as the question so that student A was able to solve it, but unlike student B who has low abilities, student B only wrote a little information and was incomplete, then from the results of the interview, student B also did not provide an answer.



(a) (b)

Figure 4 Results of Students' answers to question no. 3 (a) Student A and (b) Student b

Figure 4 is the result of the answers of students A and B which are the results of the answers to question number 3 with mathematical connection abilities that connect mathematical concepts to solve problems in everyday life. Student A is categorized as High because of the correct answer results and the systematic work flow, and student A thinks that

question number 3 is an easy question and is often found especially in everyday life, and student B finds the correct answer but in working on it only uses logic but does not match the SPLDV solution concept is also supported by the results of the interview that student B said that he found the answer from guessing and calculated coincidentally the answer was right.

From the results of the image analysis above, it is known that learning with mathematical connection skills in accordance with the learning used in one of SMP Negeri 1 Cipanas is partly good. Based on the results of the study above, there is an increase in learning using connection skills, because seen from the results of the students' answers, they can already work on the questions. So there is an interest between students and the abilities that have been tested.

4. Conclusions

The mathematical connection ability of class VIII students at SMP Negeri 1 Cipanas 2022/2023 in completing essay test questions on SPLDV material shows that the results of their abilities vary in each question indicator. Of the three questions, students can only work on a few questions but not all of them, only 1 student is able to work on all the questions. The percentage results show that students who have the ability to connect concepts between Mathematics are 68% with a moderate category, then for the ability to connect concepts between Mathematics with other studies is 63% with a moderate category and for the ability to connect mathematical concepts to solve problems in everyday life is 81% with a High category. So it can be concluded that the percentage of mathematical connections at the SMP class VII level with SPLDV material is 70.6% with a high category. The difficulties of students in working on mathematical connection ability questions are conceptual and procedural errors and these students have difficulty explaining what they have done or in other words, they still find it difficult to explain the reasons for each step in the solution. It is hoped that after this research, educators will pay more attention and be able to better guide students in mathematics subjects, especially in mathematical connection skills.

Conflict of Interest

The authors declare no conflicts of interest.

References

Angelina, M., Nia Sania Effendi, K., Singaperbangsa Karawang, U., HSRonggo Waluyo, J., Timur, K., & Barat, J. (2021). ANALISIS KEMAMPUAN KONEKSI MATEMATIS SISWA SMP KELAS IX. Maret, 4(2). https://doi.org/10.22460/jpmi.v4i2.383-394

Angriani, A. D., Nursalam, N., Fuadah, N., & Baharuddin, B. (2018). Pengembangan Instrumen Tes untuk Mengukur Kemampuan Pemecahan Masalah Matematika Siswa. AULADUNA: Jurnal Pendidikan Dasar Islam, 5(2), 211-223.

Isnaeni, S., Ansori, A., Akbar, P., & Bernard, M. (2019). Analisis kemampuan koneksi matematis siswa SMP pada materi persamaan dan pertidaksamaan linear satu variabel. Journal on Education, 1(2), 309-316.

Khairunnisa, N. C. (2019). Prosiding Seminar Nasional Matematika dan Pendidikan Matematika Sesiomadika.

Kiswanto Kenedi, A., Hendri, S., Bungsu Ladiva, H., & Kunci, K. (2018). Kemampuan Koneksi Matematis Siswa Sekolah Dasar dalam Memecahkan Masalah Matematika. In Jurnal Numeracy (Vol. 5, Issue 2).

Muwardi Kompleks Pasir Gede Raya Cianjur, J. (2020). Analisis kemampuan koneksi matematis siswa SMK pada materi trigonometri. Jurnal Analisa, 6(1), 28–39. http://journal.uinsgd.ac.id/index.php/analisa/index

Naibaho, T., Herawati Simangunsong, V., Sihombing, S., & Studi Pascasarjana Pendidikan Matematika, P. (2022). Penguatan Literasi Dan Numerasi untuk Mendukung Profil Pelajar Pancasila sebagai Inovasi Pembelajaran Matematika. 1–7. https://doi.org/10.36655/sepren.v3i2

Nugraha, A. A. (2018). Analisis koneksi matematis siswa pada materi SPLDV. Suska Journal of Mathematics Education, 4(1), 59-64.

Nuryatin, S., & Zanthy, L. S. (2019). Analisis Kemampuan Koneksi Matematis Siswa SMP Dalam Menyelesaikan Soal Persamaan Dan Pertidaksamaan Linear Satu Variabel. Journal On Education, 1(2), 61-67.

Rijal Fadli, M. (2021). Memahami desain metode penelitian kualitatif. 21(1), 33–54. https://doi.org/10.21831/hum.v21i1

Septian, A., Inayah Program Studi Pendidikan matematika, S., Keguruan dan Ilmu Pendidikan Universitas Suryakancana,