

ANALYSIS OF JUNIOR HIGH SCHOOL STUDENTS' MATHEMATICAL COMMUNICATION SKILLS ON SPLDV MATERIAL

Qory Septiani Arsandy^{1*}, Anisa Rahmadani Siregar², Victory Rajani Sinaga³, Kevin Frans Samuel Gultom⁴

^{1*,2,3,4} Universitas Negeri Medan, Medan, Indonesia

* Corresponding author. Jalan Willem Iskandar Pasar V Medan Estate, 20221, Medan, Indonesia. (9pt)

E-mail: qoryseptiani18@mhs.unimed.ac.id^{1*}
anisarahmadanisiregar@mhs.unimed.ac.id²
victory.4233111041@mhs.unimed.ac.id³
kevinsamuel07@mhs.unimed.ac.id⁴

Received February 25, 2026; Received in revised form 01 March 10, 2026; Accepted March 17, 2026

ABSTRACT

Mathematical communication skills remain a persistent challenge for many junior high school students, especially when they are required to represent ideas, explain reasoning, and connect mathematical concepts in the topic of Systems of Linear Equations in Two Variables (SLSV). This study specifically analyzes students' mathematical communication skills in the context of solving SLSV word problems using three main indicators of mathematical communication. This study uses a descriptive qualitative approach with quantitative support involving 20 ninth-grade students from the UPT SMP Negeri 27 Medan selected through purposive sampling. Data were collected through contextual SLSV word problems based on mathematical communication indicators and analyzed using the Miles and Huberman model. The results show that students' mathematical communication skills are generally at a moderate level with an average score of 75.3. In general, students are able to connect various mathematical representations and explain the basic concepts of SLSV, but difficulties remain in maintaining reasoning accuracy, procedural consistency, and correct solution interpretation. This study highlights the need for representation-based learning and problem-based learning to strengthen students' reasoning and communication processes in solving mathematical problems.

Keywords: junior high school students; mathematical communication skills; SPLDV

ABSTRAK

Kemampuan komunikasi matematika tetap menjadi tantangan yang terus-menerus bagi banyak siswa SMP, terutama ketika mereka dituntut untuk merepresentasikan ide, menjelaskan penalaran, dan menghubungkan konsep matematika dalam topik Sistem Persamaan Linear Dua Variabel (SPLDV). Penelitian ini secara khusus menganalisis kemampuan komunikasi matematis siswa pada konteks penyelesaian soal cerita SPLDV dengan menggunakan tiga indikator utama komunikasi matematis. Penelitian ini menggunakan pendekatan kualitatif deskriptif dengan dukungan kuantitatif yang melibatkan 20 siswa kelas sembilan dari UPT SMP Negeri 27 Medan yang dipilih melalui *purposive sampling*. Data dikumpulkan melalui soal cerita SPLDV kontekstual berdasarkan indikator komunikasi matematika dan dianalisis menggunakan model *Miles dan Huberman*. Hasil penelitian menunjukkan bahwa keterampilan komunikasi matematika siswa secara umum berada pada tingkat sedang dengan nilai rata-rata 75,3. Secara umum, siswa mampu menghubungkan berbagai representasi matematika dan menjelaskan konsep dasar SPLDV, tetapi kesulitan tetap ada dalam mempertahankan ketepatan penalaran, konsistensi prosedural, dan interpretasi solusi yang tepat. Penelitian ini menyoroti perlunya pembelajaran berbasis representasi dan pembelajaran berbasis masalah untuk memperkuat proses penalaran dan komunikasi siswa dalam memecahkan masalah matematika.

Kata kunci: kemampuan komunikasi matematis; siswa SMP; SPLDV



This is an open access article under the [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

Introduction

According to Law Number 20 of 2003, education is a conscious and planned effort to create an active learning environment that supports the development of students' spiritual, personal, intellectual, moral, and social potential (National, 1982). Education not only prioritizes the results of answers, but also prioritizes the process of implementation (Ministry of Education and Culture of the Republic of Indonesia, 2015). Mathematics is a subject mandated by law. Nuraida and Amam, in Aurelyasari & Nur (2022), also state that the purpose of mathematics learning is to develop students' existing mathematical abilities.

In mathematics education, communication is considered a fundamental competency that enables students to express, interpret, and justify mathematical ideas. According to Regulation of the Minister of National Education Number 22 of 2006, mathematics learning aims to develop students' ability to communicate ideas through various representations such as symbols, diagrams, tables, and other visual forms. This goal aligns with the National Council of the Teachers of Mathematics (NCTM), which emphasizes communication as a critical component in mathematics learning. In modern mathematics education, mathematics is viewed not only as a deductive discipline that develops logical and analytical thinking (Manurung et al., 2023), but also as a means to develop higher-order thinking skills, including representation, reasoning, problem-solving, and mathematical communication (Imaroh et al., 2021). Thus, mathematical communication skills refer to students' ability to represent mathematical information, explain reasoning processes, and construct mathematical models using appropriate symbols and representations when solving problems.

Mathematical communication is a fundamental component of mathematics learning that enables students to express, interpret, and discuss mathematical ideas throughout the learning process. This involves the ability to convey problem-solving strategies, reasoning, and mathematical solutions both orally and in writing (Syafina & Pujiastuti, 2020). In classroom interactions, communication occurs through dialogue between teachers and students and among students when discussing mathematical concepts and interpreting problem situations (Wardhana & Lutfianto, 2018). NCTM emphasizes that communication enables students to share and clarify mathematical ideas, making them objects of reflection and discussion. Thus, mathematical communication can be understood as students' ability to represent mathematical ideas, explain relationships between concepts, and interpret mathematical information using symbols, diagrams, graphs, or written explanations (Sarumaha et al., 2022).

The reality on the ground shows that students' mathematical communication skills are still relatively low. This is reflected in the results of the Programme for International Student Assessment (PISA), which consistently show that Indonesian students' mathematical literacy is in the low category. Empirical evidence suggests that Indonesian students' mathematical abilities remain relatively low. The 2022 PISA results showed that Indonesia achieved an average mathematics score of 366, far below the international average of 472, and ranked approximately 66th out of

78 participating countries. These results indicate that students still face difficulties in understanding and communicating mathematical ideas effectively (Kholid et al., 2025).

Mathematical communication skills play a crucial role in mathematics learning because mathematics serves not only as a tool for thinking and problem-solving but also as a language for expressing ideas clearly, logically, and precisely (Aminah et al., 2018). In line with the demands of mathematical literacy, students are expected not only to perform calculations but also to interpret information, construct mathematical models, and explain the rationale behind solutions in real-life contexts (Jannah & Hayati, 2024). One mathematics topic that significantly requires these skills is the System of Linear Equations in Two Variables (SPLDV). This topic requires students not only to apply algebraic procedures but also to translate contextual problems into mathematical models, represent the equations graphically, and interpret the intersection points as solutions to the system. This process involves connecting verbal, symbolic, and graphical representations, making SPLDV an appropriate context for testing students' mathematical communication skills. Empirical studies also show that SPLDV is relatively challenging for students. Rodiana et al. (2024) revealed that most students' errors in solving SPLDV problems occurred at the problem understanding, modeling, and interpretation stages. These findings suggest that compared to many other mathematics topics that primarily emphasize procedural calculations, SPLDV provides a more comprehensive context for analyzing students' mathematical communication skills.

Various studies have shown that students still experience difficulties in solving SPLDV problems, especially those in narrative form. Research by Utari et al. (2019) identified students' difficulties in understanding story problems and transforming them into mathematical models. This difficulty is closely related to weak symbolic representation and communication skills. Similarly, Ilmiyah et al. (2018) found that students' errors in solving SPLDV occurred not only at the calculation stage but also at the stages of understanding information and determining variables, indicating a lack of ability to communicate mathematical ideas accurately. Furthermore, Shidieq et al. (2025) highlighted student learning barriers in mathematical representation skills in SPLDV. The results of this study indicated that students had relatively good visual representation skills but struggled with symbolic and verbal representations. Therefore, a more in-depth analysis of students' mathematical communication skills is needed to understand how students represent, explain, and model mathematical ideas when solving SPLDV.

Previous research has extensively addressed students' difficulties, misunderstandings, and errors in solving SPLDV. However, most of these studies have focused primarily on procedural errors and conceptual understanding rather than on how students communicate mathematical ideas during the problem-solving process. However, mathematical communication plays a crucial role in helping students express reasoning, construct mathematical models, and interpret solutions meaningfully. Therefore, this study offers a distinct contribution by analyzing junior high school students' mathematical communication skills in solving SPLDV word problems using three specific communication indicators:

connecting representations, explaining mathematical concepts, and modeling problems using mathematical symbols. This analysis provides a deeper understanding of how students express and represent mathematical thinking during problem-solving.

This study aims to analyze junior high school students' mathematical communication skills in the subject of SPLDV. Through this analysis, it is hoped that a more in-depth profile of students' mathematical communication skills can be obtained, so that it can serve as a basis for designing more effective learning strategies to improve the quality of students' mathematical understanding and communication.

Research Methods

This research is a descriptive qualitative study. This study does not specifically study the relationship between existing variables, because the main purpose of descriptive research is to describe symptoms, phenomena, or social realities, not to find the causes of these symptoms (Syahrizal & Jailani, 2023). This research was conducted at the UPT SMP Negeri 27 Medan with 20 students of grade IX-1 as subjects. In determining the research subjects, the researcher used a subject selection technique, namely purposive sampling. The purposive sampling technique is a sampling technique determined directly by the researcher with various special considerations (Nugraha and Pujiastuti, 2019). The research instrument used was SPLDV story problems that refer to indicators of students' mathematical communication abilities.

The research instrument used in this study consisted of essay-style story problems related to SPLDV, designed to measure students' mathematical communication skills. The indicators for mathematical communication skills refer to the framework proposed by Sumarmo, as cited in Yanti et al. (2019), which includes six indicators: (1) expressing real-world situations, diagrams, or objects in mathematical language or symbols; (2) explaining mathematical ideas and relationships orally or in writing; (3) listening, discussing, and writing about mathematics; (4) reading mathematical presentations with understanding; (5) constructing conjectures and arguments; and (6) restating mathematical descriptions in one's own words.

However, this study focused only on three indicators deemed most relevant to the characteristics of the SPLDV material and the research objectives. These indicators emphasize students' ability to represent, explain, and model mathematical problems, which is essential in solving contextual problems involving systems of linear equations. The three indicators used in this study were: (1) connecting graphs, images, and tables into mathematical forms; (2) explaining mathematical concepts orally or in writing using graphs, pictures, and tables logically; and (3) using mathematical symbols and language to model a mathematical problem.

The instrument consists of five essay questions designed to measure students' mathematical communication skills based on selected indicators. Before being used in the study, the instrument was validated by mathematics education experts to ensure its content validity. Furthermore, the instrument's reliability was tested to ensure the consistency of the measurement results. All questions were

analyzed to identify students' abilities to represent, explain, and model mathematical ideas. However, due to space limitations in this article, only one problem is presented as a representative example; this problem was chosen because it represents the indicators of mathematical communication analyzed in this study. The selected problem illustrates the general pattern of student responses and reflects the characteristics of errors and difficulties also encountered in other questions. Therefore, the analysis of this problem is expected to provide a clear representation of students' mathematical communication skills in solving SPLDV problems.

The data analysis technique used the Miles and Huberman model, which consists of data reduction, data presentation, and drawing conclusions (Sugiyono, 2021). Data from written tests were analyzed by accumulating answer scores to assess students' mathematical communication skills. After data collection, they were analyzed to identify important patterns, meanings, and relationships. The results of the analysis were presented in tables and descriptive descriptions for easier understanding. The results were then interpreted to provide deeper meaning. The final stage involved drawing conclusions based on the research findings, which answered the research questions and could serve as the basis for recommendations (Yuliani, 2018). The following is a diagram of data analysis techniques shows in Figure 1:

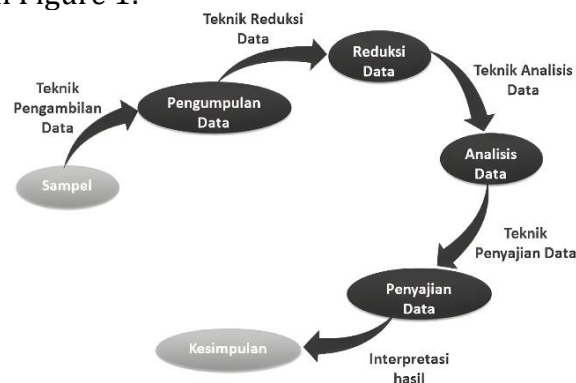


Figure 1. Data Analysis Technique Diagram (Source: Mentari, 2019)

The final score for students' mathematical communication skills in solving problems is calculated using the formula according to Dianti in Nurhaliza & Kartika (2025), as follows:

$$Final\ score\ (NA) = \frac{scores\ obtained\ by\ students}{maximum\ score} \times 100\%$$

The final score for students' mathematical communication skills obtained will then be interpreted according to Arikunto in Nurhaliza & Kartika (2025), as shown in Table 1.

Table 1. Categories of Students' Mathematical Communication Abilities

Score Range	Category
$x_i \geq \bar{x} + s$	Tall
$\bar{x} - s \leq x_i < \bar{x} + s$	Medium
$x_i < \bar{x} - s$	Low

Information:

x_i = Student score

\bar{x} = Mean score

s = Standard deviation

Based on Table 1, the categorization of students' mathematical communication ability was determined using the mean and standard deviation criteria. Students whose scores were greater than or equal to the mean plus the standard deviation were categorized as having high ability. Students whose scores were between the mean minus the standard deviation and the mean plus the standard deviation were categorized as having medium ability, while students whose scores were below the mean minus the standard deviation were categorized as having low ability.

Results and Discussion

This study aims to analyze and describe the mathematical communication skills of ninth-grade junior high school students in solving word problems related to the Two-Variable Linear Equation System (SPLDV) topic. The mathematical communication skills test consists of five questions with a maximum score of 100 and a minimum score of 0. The descriptive statistics calculation table obtained from the results of the students' mathematical communication skills test scoring can be seen in Table 2.

Table 2. Description of Mathematical Communication Skills

N	Min	Max	Mean	Median	Standar Deviasi
20	63	90	75,3	74,5	7,96

Based on Table 2, the average score was 75.3 and the standard deviation was 7.96. These two scores will be used to categorize the data into high, medium, and low categories. The grouping of student scores based on the mathematical communication ability test instrument can be seen in Table 3 below.

Table 3. Percentage of Grade IX Students' Mathematical Communication Ability Levels.

No	Score	Level of Ability	Student	Total	Persentase
1.	$score \geq 83,26$	Tall	S8, S15, S4, S11	4	20%
2.	$67,34 \leq score < 83,26$	Currently	S18, S6, S20, S2, S12, S9, S16, S5, S13, S1, S17, S7	12	60%
3.	$score < 67,34$	Low	S3, S14, S19, S10	4	20%

From Table 3 above, it can be seen that the results of students' answers based on the predetermined scoring guidelines show that students' mathematical communication skills have different levels of ability, including 4 students with a high category with a percentage of 20%, 12 students with a medium category with a percentage of 60%, and 4 students with a low category with a percentage of 20%.

In explaining mathematical communication skills in SPLDV material, the researcher will first carry out a more in-depth analysis of the results of the

answers generated based on 3 indicators of mathematical communication skills, including:

Given two equations:
 $x + y = 6$
 $2x + y = 9$

- Determine two points for each equation.
- Draw the graphs of both equations on the coordinate plane.
- Determine the point of intersection of the two lines and explain

The following are the answers from high-skill students (S8), presented in Figure 2.

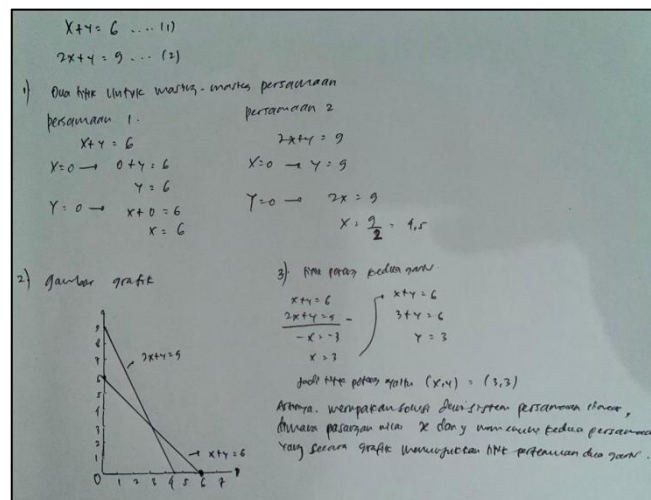


Figure 2. S8's Answer

Based on S8's response to a problem involving two linear equations, determining pairs of points, graphing, and identifying intersection points, it can be observed that the student demonstrated a comprehensive level of mathematical communication skills. S8 was able to correctly identify the information presented in the problem and represent the equations symbolically before determining the pairs of points that satisfy each equation. This process demonstrates that the student is able to translate symbolic expressions into numerical representations and then into graphical form. The ability to connect these representations reflects an integrated understanding of mathematical concepts, where symbolic, numerical, and visual representations are used coherently to explain the relationship between the two equations. Furthermore, S8 provided a logical explanation of the solution process, including the rationale for selecting specific points, the graphing procedure, and the interpretation of the intersection points as solutions to the system. This explanation demonstrates that the student not only performed procedural calculations but also articulated the reasoning underlying each step of the solution. The consistent use of mathematical symbols and language, along with the systematic application of elimination and substitution methods to obtain the solution (3,3), demonstrates that the student is able to communicate mathematical

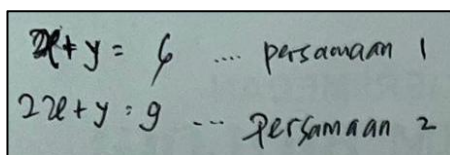
ideas clearly and accurately. These findings indicate that S8 possesses a strong conceptual understanding and the ability to effectively represent and explain mathematical ideas, placing the student in the high category of mathematical communication skills. The abilities demonstrated by S8 can be explained by several factors. Students with strong mathematical communication skills generally have stronger conceptual understanding and are able to integrate various forms of mathematical representation when solving problems.

According to representation theory, mathematical understanding is built through the ability to flexibly move between different representations such as symbolic, graphic, and verbal forms. The successful transformation of information from word problems into symbolic equations and graphical representations in S8's responses demonstrates the student's ability to effectively coordinate these representations. Furthermore, from a semiotic perspective, mathematical symbols function as a sign system used to express and communicate mathematical meaning. S8's ability to use symbols consistently and interpret intersection points as solutions to the system reflects the student's understanding of the meaning contained in these mathematical signs.

From a constructivist perspective, these abilities also indicate that the student actively constructs knowledge by connecting prior understanding with the information presented in the problem. Through this process, the student is able to organize ideas, justify solution strategies, and communicate reasoning logically. This finding is consistent with the results reported by Syafina and Pujiastuti (2020), who found that students with strong mathematical communication skills tend to explain mathematical concepts and solution strategies using various representations, such as tables, diagrams, and mathematical models. The ability to integrate these representations supports deeper conceptual understanding and allows students to communicate mathematical reasoning more clearly and systematically.

The following are the answers of students in the medium category (S5) which can be seen in Figure 3.

Indicator 1. Connecting graphs, images, and tables into mathematical forms .



The image shows a handwritten note on a light blue background. It contains two linear equations in two variables. The first equation is $x + y = 6$ followed by "... persamaan 1". The second equation is $2x + y = 9$ followed by "... persamaan 2".

Figure 3. S5's Answer: First Indicator

Based on S5's response to a problem involving two linear equations, the student was able to identify key information by identifying several pairs of points from each equation and using them to graph them on a coordinate plane. This demonstrates that S5 understands the relationship between symbolic equations and their graphical representations as straight lines. From a representation theory perspective, this ability reflects the student's capacity to transform symbolic representations into visual representations, which is an essential component of mathematical communication.

Indicator 2. Explain mathematical concepts orally or in writing using graphs, pictures, and tables rationally shows in Figure 4.

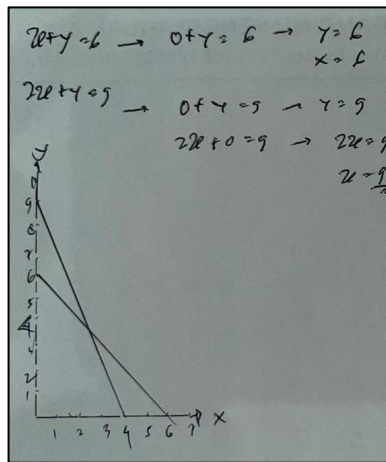


Figure 4. S5's Answer: Second Indicator

In the second indicator, S5 explained that the two equations form two straight lines and their intersection point represents the solution to the system of equations. Although this explanation demonstrates a basic conceptual understanding of the relationship between the two equations, it is relatively brief in the solution process. For example, S5 does not clearly explain how the intersection point is obtained or how each point plotted on the graph satisfies the corresponding equation. From a constructivist perspective, this condition indicates that the student has begun to build conceptual understanding but has not yet fully internalized the reasoning processes necessary to communicate mathematical ideas comprehensively. Consequently, the student's ability to provide rational explanations is still limited and categorized as moderate shows in Figure 5.

Indicator 3. Use mathematical symbols and language to model a mathematical problem.

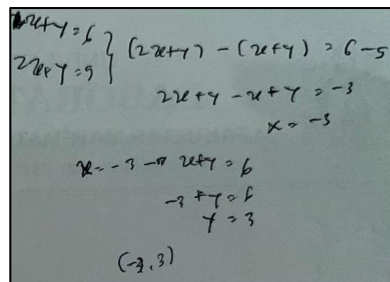


Figure 5. S5's Answer: Third Indicator

In the third indicator, S5 correctly wrote a mathematical model according to the problem context and attempted to apply algebraic procedures to determine the intersection points. However, errors occurred during the algebraic manipulation process, particularly during the elimination or substitution steps, resulting in an incorrect final answer. S5's errors may have been influenced by several factors, including difficulty coordinating various representations such as symbolic manipulation and graphical interpretation, as well as limited procedural fluency in algebraic operations when applying elimination or substitution methods. Furthermore, students often focused on obtaining the final answer rather than explaining the reasoning process, which could reduce the accuracy of intermediate calculations. From a semiotic perspective, mathematical symbols function as a sign system that represents mathematical meaning. Difficulty manipulating these

symbols indicates that students do not fully understand the relationships embedded in symbolic representations. Consequently, S5's use of mathematical language and symbols appears inconsistent and inaccurate, placing the student's performance in the moderate category.

This finding is consistent with the results reported by Octaviani and Noor (2022), who found that students frequently make calculation errors when determining the final solution. However, this study has several limitations. The analysis was based solely on students' written responses to a limited number of problems, which may not fully capture the breadth of students' mathematical communication skills. Furthermore, this study focused solely on the topic of systems of linear equations in two variables, so the findings may not be representative of students' communication skills in other mathematical topics. Therefore, mathematics teachers are encouraged to design learning activities that emphasize not only procedural problem solving but also the development of mathematical communication skills by encouraging students to explain their reasoning, connect various representations, and discuss and justify their solutions, which can strengthen conceptual understanding and reduce errors in algebraic manipulations.

The following are the answers of low category students (S10) which can be seen in Figure 6.

$$\begin{aligned} \left. \begin{array}{l} x+y=6 \\ 2x+y=9 \end{array} \right\} & \begin{array}{l} (2x+y) - (x+y) = 6-9 \\ 2x+y-x-y = -3 \\ x = -3 \end{array} \\ \\ & \begin{array}{l} x+y=6 \\ -3+y=6 \\ y=6+3=9 \end{array} \end{aligned}$$

$(-3, 9)$

Figure 6. S10's Answer

Based on S10's response to the SPLDV problem, the student has not yet fully met the three indicators of mathematical communication skills. S10 was unable to identify the correct pair of points that satisfy the equation, resulting in an inaccurate graph that does not adequately represent the linear relationship. This demonstrates difficulty connecting symbolic equations to their graphical representations. From a representation theory perspective, this indicates that the student has not yet developed the ability to effectively coordinate multiple mathematical representations. Furthermore, S10's explanation was very limited and did not demonstrate clear mathematical reasoning regarding the relationship between equations, graphs, and the meaning of intersection points. From a constructivist perspective, this reflects an incomplete conceptual construction of the system of linear equations. Errors were also identified in the algebraic manipulation process, leading to incorrect solution models and final results. In semiotic terms, these errors indicate that the student does not fully understand the meaning and function of mathematical symbols in representing relationships between quantities.

These difficulties may be caused by several factors, including limited ability to translate symbolic representations into graphical form, low procedural fluency in algebraic operations, and misunderstanding of the intersection point as a simultaneous solution to two linear equations. These findings support a study by Cahyono (Nurhaliza & Kartika, 2025), which stated that students often experience difficulties in understanding basic concepts in algebraic operations. However, this study further demonstrated that students' errors were not only procedural but also related to difficulties in coordinating representations and communicating mathematical ideas.

The findings of this study indicate that junior high school students' mathematical communication skills in solving SPLDV word problems generally fall within the moderate category. 60% of students were classified as moderate, 20% as high, and 20% as low. These results indicate that most students are able to connect mathematical representations, such as translating equations into graphical form and identifying the intersection point as a solution to a system of equations. However, some students still have difficulty explaining their reasoning processes and consistently applying algebraic procedures when determining solutions. Several factors contributed to this study: students tended to focus more on procedural calculations than on explaining the rationale behind each solution step. Furthermore, students' limited conceptual understanding of algebraic operations and symbolic manipulations could impact their ability to communicate mathematical ideas clearly and systematically. As a result, students might be able to identify the general concept of SPLDV but still make errors in the elimination or substitution process when determining the intersection point.

The results of this study are consistent with previous research discussed in the introduction. For example, Syafina and Pujiastuti (2020) found that students with higher mathematical communication skills were generally able to explain mathematical concepts using various representations such as graphs, tables, and models.

This study has several strengths and limitations. One strength is that it provides a detailed qualitative analysis of students' mathematical communication skills based on three indicators, allowing for a deeper understanding of how students represent, explain, and model mathematical problems in SPLDV materials. However, limitations of this study lie in the relatively small number of subjects and the focus on only one school context, which may limit the generalizability of the findings.

The results of this study provide theoretical and practical implications. Theoretically, this research contributes to the development of studies on mathematical communication by providing empirical evidence regarding students' communication skills in SPLDV learning. Practically, the findings highlight the need for learning strategies that emphasize explanation, discussion, and the use of various representations in mathematics learning. Teachers are encouraged to design learning activities that actively engage students in expressing mathematical ideas, explaining solution processes, and interpreting results in real-life contexts, so that students' mathematical communication skills can develop optimally.

This research highlights the importance of integrating mathematical communication activities into classroom learning, as the ability to express and

justify mathematical reasoning plays a crucial role in developing students' conceptual understanding.

Conclusion and Suggestion

Based on the research objective to analyze students' mathematical communication skills in the Two-Variable Linear Equation System (SPLDV) material, the results of the study indicate that the mathematical communication skills of grade IX students are generally in the moderate category with an average score of 75.3. This score indicates that in general, students' abilities have exceeded the Minimum Completion Criteria (KKM) which is generally in the range of 70–75, so it can be said that most students have achieved a sufficient level of mastery in connecting mathematical representations, explaining concepts, and modeling problems using mathematical symbols. However, the research findings also indicate that there are still some students who experience difficulties in explaining the reasoning process completely and in performing algebraic manipulations consistently. Therefore, the results of this study indicate that students' mathematical communication skills in the SPLDV material are quite good but still need to be improved, especially in the aspects of mathematical reasoning and procedural accuracy in problem solving.

Further research suggests that mathematics teachers design learning that not only emphasizes procedural calculations but also the development of students' mathematical communication skills, for example through mathematical discussion activities, the use of various representations (graphics, symbols, and verbal), and the provision of contextual problems that encourage students to explain their reasoning processes more systematically. In addition, further research suggests developing learning models or strategies specifically designed to improve students' mathematical communication skills in various mathematical materials, and involving a wider number of subjects and different school contexts in order to obtain a more comprehensive picture of the factors that influence students' mathematical communication skills.

Reference

- Agustini, D., & Pujiastuti, H. (2020). Analisis Kesulitan Siswa Berdasarkan Kemampuan Pemahaman Matematis Dalam Menyelesaikan Soal Cerita Pada Materi SPLDV. *Jurnal Pendidikan Matematika*, 14(2), 123–134. (<https://doi.org/10.33394/mrpm.v8i1.2568>)
- Aminah, S., Wijaya, T. T., & Yuspriyati, D. (2018). Analisis Kemampuan Komunikasi Matematis Siswa Kelas Viii Pada Materi Himpunan. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 2(1), 15-22. (<https://doi.org/10.31004/cendekia.v2i1.29>)
- Aurelyasari, S., & Nur, I. R. D. (2022). Analisis Kemampuan Komunikasi Matematis Siswa Smp Pada Materi Aljabar. *Radian Journal: Research and Review in Mathematics Education*, 1(3), 127-134. (<https://doi.org/10.35706/rjrrme.v1i3.7153>)
- Depdiknas. 2006. *Permendiknas Nomor 22 Tentang Standar Isi Untuk Satuan Pendidikan Dasar dan Menengah*. Jakarta: Departemen Pendidikan Nasional.
- Ilmiyah, L., Purnama, S., & Mayangsari, S. N. (2018). Analisis Kesalahan Peserta Didik Dalam Menyelesaikan Soal Cerita Sistem Persamaan Linear Dua

- Variabel. *AULADUNA: Jurnal Pendidikan Dasar Islam*, 5(1), 105–115. (<https://doi.org/10.24252/auladuna.v5i1a9.2018>)
- Imaroh, N. A., Pujiastuti, H., & Tirtayasa, A. (2021). Analisis Kesulitan Siswa Dalam Menyelesaikan Soal Matematika Dan Implikasinya Terhadap Pembelajaran. *JP3M (Jurnal Penelitian Pendidikan dan Pengajaran Matematika)*, 7(2), 87–96. (<https://doi.org/10.37058/jp3m.v7i2.3167>)
- Jannah, M., & Hayati, M. (2024). Pentingnya Kemampuan Literasi Matematika Dalam Pembelajaran Matematika. *Griya Journal of Mathematics Education and Application*, 4(1), 40–54. (<https://doi.org/10.29303/griya.v4i1.416>)
- Kemendikbud RI. 2015. *Salinan Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 53 Tahun 2015 Pasal 5*, [Online]. Tersedia: <https://www.kemdikbud.go.id/main/blog/2015/06/permendikbud-no-12-tahun-2015-tentang-program-indonesia-pintar-4285-4285>. [23 Februari 2026]
- Kholid, M. N., Widyasari, A., Santosa, Y. T., Hidayati, Y. M., Fenyvesi, K., Maharani, S., ... & Hendriyanto, A. (2025). Student metacognition levels for solving PISA-like problems: A hierarchy. *Infinity Journal*, 14(3), 817-838. (<https://doi.org/10.22460/infinity.v14i3.p817-838>)
- Manurung, A. S., Fahrurrozi, F., Utomo, E., & Gumelar, G. (2023). Implementasi berpikir kritis dalam upaya mengembangkan kemampuan berpikir kreatif mahasiswa. *Jurnal Papeda: Jurnal Publikasi Pendidikan Dasar*, 5(2), 120–132. Retrieved from <https://e-journal.unimudasorong.ac.id/index.php/jurnalpendidikandasar/article/view/1831>
- Mentari, D. & Astuti, Y. (2019). *Buku Ajar Teknologi Bank Darah – Karya Tulis Ilmiah*.
- Nasional, U. S. P. (1982). Introduction and aim of the study. *Acta Pædiatrica*. 71, 6–6. <https://doi.org/10.1111/j.1651-2227.1982.tb08455.x>
- NCTM. 2000. *Principles and Standard for School Mathematics*. Virginia: NCTM inc.
- Nugraha, T. H. dan Pujiastuti, H. 2019. Analisis Kemampuan Komunikasi Matematis Siswa Berdasarkan Perbedaan Gender. *Edumatica: Jurnal Pendidikan Matematika*. 9(1), 1–7. (<https://doi.org/10.22437/edumatica.v9i1.5880>)
- Nurhaliza, M., & Kartika, H. (2025). Analisis Kemampuan Komunikasi Matematis Siswa SMA dalam Menyelesaikan Soal Cerita Materi SPLTV. *Didactical Mathematics*, 7(1), 119-129. <https://doi.org/10.31949/dm.v7i1.13391>
- Octaviani, E., & Noor, A. I. (2022). Analisis Kemampuan Komunikasi Matematis Siswa. *Jurnal Ilmiah Fakultas Keguruan Dan Ilmu Pendidikan*, 8(1), 84–92. (<https://doi.org/10.35569/biormatika.v8i1.1225>)
- Syafira, D. R. A., & Zulkarnaen, R. (2022). Analisis Kemampuan Komunikasi Matematis Siswa Berdasarkan Teori Kastolan. *Biormatika: Jurnal ilmiah fakultas keguruan dan ilmu pendidikan*, 8(1), 84-92.
- Rodiana, I., Hamdiyanti, M., Laelasari, L., & Subroto, T. (2024). Students' skills to solve linear equation system in two variables: Systematic literature review. *Jurnal PAJAR (Pendidikan dan Pengajaran)*, 8(3), 249–260. (<https://doi.org/10.33578/pjr.v8i3.9853>)
- Sarumaha, K. S., Sarumaha, R., & Gee, E. (2022). Analisis Kemampuan Komunikasi Matematis Siswa Pada Materi SPLDV Di Kelas VIII SMPN 3 Maniamolo

- Tahun Pembelajaran 2020/2021. *AFORE: Jurnal Pendidikan Matematika*, 1(1), 1-14. (<https://doi.org/10.57094/afore.v1i1.432>)
- Shidieq, B. A., Mujib, M., Putra, R. W. Y., & Mardiyah, M. (2025). Analisis Hambatan Belajar Kemampuan Representasi Matematis Materi Sistem Persamaan Linear Dua Variabel. *Jurnal Pendidikan Matematika*, 19(1), 45–58.
- Sugiyono. (2021). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D (29th ed.)*. Bandung: Alfabeta.
- Syafina, V., & Pujiastuti, H. (2020). Analisis Kemampuan Komunikasi Matematis Siswa Pada Materi SPLDV. *MAJU: Jurnal Ilmiah Pendidikan Matematika*, 7(2), 118–125. <https://media.neliti.com/media/publications/502800-none-537e14bb.pdf>
- Syahrizal, H., & Jailani, M. S. (2023). Jenis-Jenis Penelitian Dalam Penelitian Kuantitatif Dan Kualitatif. *QOSIM: Jurnal Pendidikan, Sosial & Humaniora*, 1(1), 13-23. (<https://doi.org/10.61104/jq.v1i1.49>)
- Utari, D. R., Wardana, M. Y. S., & Damayani, A. T. (2019). Analisis Kesulitan Belajar Matematika Dalam Menyelesaikan Soal Cerita. *Jurnal Ilmiah Sekolah Dasar*, 3(4), 534–540. (<https://doi.org/10.23887/jisd.v3i4.22311>)
- Wardhana, I. R., dan Lutfianto, M. (2018). Analisis Kemampuan Komunikasi Matematis Siswa Ditinjau dari Kemampuan Matematika Siswa. *UNION: Jurnal Ilmiah Pendidikan Matematika*, 6 (2), 173–184.
- Yanti, R. N., Melati, A. S., & Zanty, L. S. (2019). Analisis Kemampuan Pemahaman Dan Kemampuan Komunikasi Matematis Siswa SMP Pada Materi Relasi Dan Fungsi. *Jurnal cendekia*, 3(1), 209-219. (<https://doi.org/10.31004/cendekia.v3i1.95>)
- Yuliani, W. (2018). Metode Penelitian Deskriptif Kualitatif Dalam Perspektif Bimbingan Dan Konseling. *QUANTA: Jurnal Kajian Bimbingan Dan Konseling Dalam Pendidikan*, 2(2), 83-91. (<https://doi.org/10.22460/q.v2i2p83-91.1641>)