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Analysis of students' mathematical communication skills in terms of learning styles through realistic mathematics learning

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Abstract

Salah satu upaya meningkatkan hasil belajar matematika adalah dengan memahami kemampuan komunikasi matematis siswa. Hal tersebut dapat dioptimalkan apabila guru mengetahui pula jenis gaya belajar yang dimiliki oleh siswa. Cara lain adalah dengan menerapkan pembelajaran yang sesuai, diantaranya adalah model pembelajaran matematika realistik. Berdasarkan hal tersebut, dilakukan penelitian untuk menganalisis kemampuan komunikasi matematis siswa yang ditinjau dari gaya belajar melalui pembelajaran matematika realistik. Jenis penelitian ini adalah penelitian kualitatif dengan jumlah subjek 44 siswa XI MIA 2 MAS SIMBANGKULON. Teknik pengumpulan data yang digunakan adalah angket, tes, dan wawancara. Hasil penelitian ini menunjukkan bahwa persentase kemampuan komunikasi matematis yang paling dominan pada gaya belajar visual, auditorial, read/write dan kinestetik adalah pada indikator ketiga, yaitu mengungkapkan ide-ide matematis dalam menyelesaikan permasalahan sehari-hari. Dilain pihak, penyebab kesulitan siswa dalam berkomunikasi matematis adalah bervariasi, tetapi yang paling dominan untuk setiap kelompok gaya belajar adalah sama, yaitu kekurangtelitian.

One of the efforts to improve mathematics learning outcomes is understanding students' mathematical communication skills. This can be optimised if teachers also know the types of learning styles that students have. Another way is to apply appropriate learning, including the realistic mathematics learning model. Based on this, a study was conducted to analyse students' mathematical communication skills in terms of learning styles through realistic mathematics learning. This type of research is qualitative research with the number of subjects 44 students XI MIA 2 MAS SIMBANGKULON. The data collection techniques used were questionnaires, tests, and interviews. The results showed that the most dominant percentage of mathematical communication skills in visual, auditorial, read/write, and kinesthetic learning styles was in the third indicator, namely, expressing mathematical ideas in solving everyday problems. On the other hand, the causes of students' difficulties in communicating mathematically are varied, but the most dominant for each learning style group is the same, namely lack of rigour.

Keywords: Learning Style, Mathematical Communication Skills, Realistic Mathematics Learning.

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INTRODUCTION

Learning mathematics is a mathematics teaching-learning activity that involves acquiring information, skills, and the best possible usefulness for oneself and others in real-world situations (Labina and Resi, 2020). According to NCTM (Astri, 2022), students must actively build new knowledge from their previous experiences and mathematical knowledge. The five basic standards for learning mathematics are problem-solving, reasoning and proof, communication, connection, and representation. Mathematical communication, defined by Umaedi in Labina and Resi (2020), is the ability to explain mathematical ideas coherently to friends, teachers, and others through oral and written language.

Mathematical communication is essential for finding and gathering information, data and facts needed to process and apply mathematics. However, students often have difficulty solving problems and modelling mathematics in line with a study conducted by Sibarani, Simanjorang, and Mukhtar (2022). In the paper, they explained that students' mathematical communication skills (or, we shorten it as MCS) are still relatively low. PISA statistics from 2018 showed that Indonesian students' average mathematics success score was 379 and ranked 72nd on a scale of 1 to 78 (Asuro and Fitri, 2020). This indicates that students in Indonesia tend to answer relatively easy mathematics questions and are less able to communicate mathematics.

In this study, the authors considered students' mathematical communication indicators based on a paper due to Dianti, Amaliyah, and Rini (2022), which include (1) connecting real objects and images into mathematical ideas, (2) expressing everyday events using mathematical symbols and terms when presenting mathematical ideas orally and in writing, (3) expressing mathematical ideas in solving everyday problems, and (4) completing a description or paragraph related to mathematics using their language.

Based on information obtained from the mathematics teacher of MAS Simbangkulon, it is stated that students' mathematical communication skills are still low.

We see this from the students' activities in solving problems, especially story-form problems. Students also have difficulty distinguishing the use of mathematical symbols, translating mathematical forms into real-world problems, and translating contextual problems into mathematical models.

Furthermore, the teacher often uses the lecture learning method. Through this method, the teacher provides real-life examples without giving detailed explanations or collaborating with other students to find information on the mathematics subject.

Based on the two paragraphs above, the author is interested in knowing the aspects of mathematical communication of students in the school, including the factors that cause it. It is known that several factors affect mathematical communication, one of which is learning style. Learning styles indicate the way of learning preferred by students (Shinta & Aini, 2023). According to research by Daimaturrohmatin and Rufiana (2019), characteristics related to student learning styles have an impact on students' mathematical communication skills. In addition, Erawati and Putri (2019) said that one way to optimise students' mathematical communication skills is by choosing the appropriate learning style.

There are several ways to categorise learning styles, one of which is the unimodal learning style, which can be explained as follows. Visual learning style (V) is a learning style that relies on the sense of sight (eyes), auditorial learning style (A) is a learning style that relies on the auditory system, read/ write learning style (R) is learning in a read or write method, while kinesthetic learning style (K) is a learning style that relies on sensory input from touch and physical movement to process knowledge (Haryono, 2021).

Learning models affect students' mathematical communication skills in addition to learning styles. Yuliyanti, Masykur, and Suri (2021) suggested that a realistic mathematics learning approach can improve students' mathematical communication skills.

A paradigm in mathematics education known as realistic mathematics education is based on Freudenthal's statement that mathematics is a human activity and should be related to the context of students' daily lives (Paroqi, Mursalin, & Marhami, 2020; Mahfudhah, Hamidah, & Wulan, 2022). Nasriyah (2019) stated that the importance of the real context known to students and the process of building their mathematical knowledge are two advantages of realistic mathematics learning. This learning emphasises students'

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activities to search, discover, and build their knowledge so that learning becomes student-centred. Realistic mathematics learning can improve students' mathematical communication skills.

Based on the explanation above, this study presents an analysis of mathematical communication skills in terms of unimodal learning styles (V-A-R-K) through realistic mathematics learning. The research subjects are students of class XI MIA 2 MAS SIMBANGKULON.

METHODS

The type of research is qualitative research with a case study approach. Our focus is on the students' mathematical communication skills (MCS), which are seen in the students' learning styles through realistic mathematics learning. The subjects in the study were students of class XI MIA 2 MAS SIMBANGKULON, consisting of 44 students. The data collection methods used in this research are questionnaires, tests, and interviews. Questionnaires are used to determine the type of learning style of students. The questionnaire consists of 20 items in the form of multiple-choice questions. This questionnaire has gone through a validity test and a reliability test. The validity formula used is the V Aiken formula. The result of this questionnaire validity test is 0.73, which is the right interpretation. The V Aiken formula is as follows (Arham, 2022).

$$V = \frac{\sum s}{n(c-1)}$$

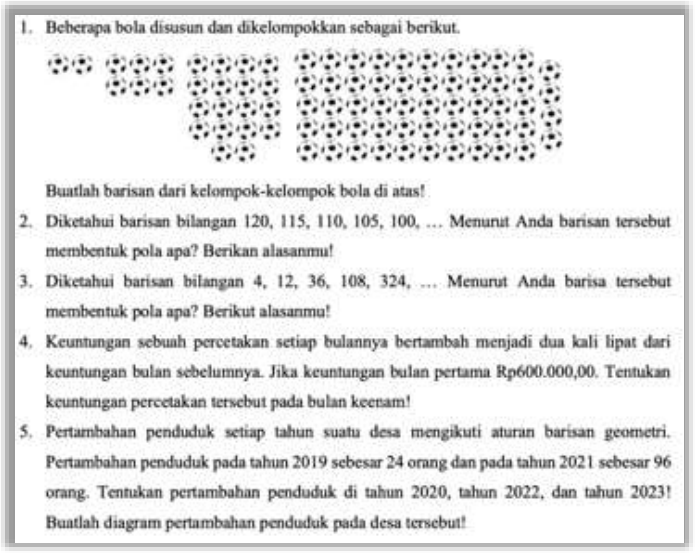
The questionnaire's reliability uses the test-retest method, i.e., we take the data twice. The formula used is product-moment correlation. We obtained an appropriate and precise reliability interpretation based on our calculation. Therefore, this non-test instrument is reliable to use. The product-moment correlation formula is as follows (Purba and Purba, 2022).

$$r_{xy} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{[n\sum X^2 - (\sum X)^2].[n\sum Y^2 - (\sum Y)^2]}}$$

Written tests were used to determine students' mathematical communication skills based on realistic mathematics. This written test consists of 5 items. The questions used in the study are attached in Figure 1 above. This written test was conducted through the validity and reliability tests, which obtained results of 0.76 and 0.87, respectively. The

validity formula used is the V Aiken formula. The reliability formula used is Cronbach's alpha. The Cronbach alpha formula is as follows (Lestari and Yudhanegara, 2018).

$$r = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum s_i^2}{s_i^2}\right)$$



1. Beberapa bola disusun dan dikelompokkan sebagai berikut.

Buatlah barisan dari kelompok-kelompok bola di atas!

2. Diketahui barisan bilangan 120, 115, 110, 105, 100, … Menurut Anda barisan tersebut membentuk pola apa? Berikan alasanmu!
3. Diketahui barisan bilangan 4, 12, 36, 108, 324, … Menurut Anda barisa tersebut membentuk pola apa? Berikut alasanmu!
4. Keuntungan sebuah percetakan setiap bulannya bertambah menjadi dua kali lipat dari keuntungan bulan sebelumnya. Jika keuntungan bulan pertama Rp600.000,00. Tentukan keuntungan percetakan tersebut pada bulan keenam!
5. Pertambahan penduduk setiap tahun suatu desa mengikuti aturan barisan geometri. Pertambahan penduduk pada tahun 2019 sebesar 24 orang dan pada tahun 2021 sebesar 96 orang. Tentukan pertambahan penduduk di tahun 2020, tahun 2022, dan tahun 2023! Buatlah diagram pertambahan penduduk pada desa tersebut!

Figure 1. MCS Test Questions

The written test has also undergone a question feasibility test. Based on the results of the differentiator test and the level of difficulty test, 5 out of 8 test items are feasible to use.

The interview was used to triangulate the technique of the written test above. The interview sheet has gone through a validity test, which obtained a result of 0.76. it belongs to the right interpretation category. The interviews were conducted on eight students, i.e., two students from each type of learning style. The data used in this study were analysed based on the Miles and Huberman model. According to Lintang, Febriyanti, Furqoni, & Sihotang (2022), data analysis based on the Miles and Huberman model consists of data reduction, data presentation, and conclusion drawing stages.

RESULT AND DISCUSSION

Result

Before the data was analysed, the data classification stage was carried out in the form of learning style types of students in class XI MIA 2 MAS SIMBANGKULON. At this stage, data was obtained from a learning style questionnaire based on each indicator of the unimodal learning style (V-A-R-K). The results of the grouping of student learning

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styles are as follows.

Table 1. Learning Style Grouping

Group	Number of Students
Visual	Seven students
Auditorial	16 students
Read/write	11 students
Kinesthetic	Ten students

Based on the results of the classification of learning styles in Table 1, we analyse the mathematical communication ability test on each type of learning style. It should be noted that the test consists of 5 description questions based on mathematical communication indicators. In the following section, we present the percentage of student success based on the indicator of mathematical communication ability and the type of learning style.

Table 2. MCS Success Percentage

	MCS 1	MCS 2	MCS 3	MCS 4	Marginal Average
V	60,71%	85,71%	96,43%	85,71%	82,11%
A	73,44%	87,50%	89,0%	77,34%	81,82%
R	70,45%	79,54%	93,18%	86,36%	82,38%
K	65%	80%	90%	87,50%	80,62%

Based on Table 2, it can be concluded that the dominant indicator of mathematical communication ability in each learning style of students in class XI MIA 2 MAS SIMBANGKULON is the MCS3 indicator, namely, expressing mathematical ideas when solving everyday problems. This is indicated by the percentage of visual learning style 96.43%, auditorial learning style 89.0%, read/write learning style 93.18%, and kinesthetic learning style 90%. The results of the analysis of mathematical communication skills (MCS) in each learning style are as follows.

Visual Learning Style

- Data Reduction

Visual learning style is represented by subjects S-10 and S-31. The results of each student's work on questions representing the first MCS indicator, namely connecting real objects and images into mathematical ideas, are as follows.

Figure 2. Subject S-10's Result Problem 1

Figure 3. Subject S-31's Result Problem 1

Based on Figure 2 and Figure 3, it can be seen that S-10 and S-31 did not write the information known from the picture in the problem. Subjects S-10 and S-31 only wrote the line pattern formed from the realistic problem. However, the line pattern answered by S-10 and S-31 is still incorrect. Based on the interview results, this happened because S-10 and S-31 were not careful in calculating the number of balls in the picture. In the following, we also attach a result of an interview excerpt from one of the students, namely S-10.

R: "Look at the question number one. From the question, what can you conclude?"
S-10: "This question asked to make a number pattern, right, Miss?"
R: "Yes, that's right. What information do you get from this picture?"
S-10 : "There are four groups of balls, Miss"
R : "Exactly. Now, how many balls are there in each group, Miss?"
S-10 : "The first group has 2 balls, the second group has 6 balls, the third group has 18 balls, and the fourth group has 58 balls."
R : "Are you sure of your answer?"
S-10 : "I'll count again, Miss"
R : "Please"
S-10 : "Wrong, Miss. Group four has 54 balls. Hehe sorry, Miss, I miscounted."
R : "Next time be more thorough"

The results of the analysis of visual students' MCS on the second indicator are as follows. Based on the test results, S-10 could not solve contextual problems related to geometric series well. S-10 only drew the population growth diagram without writing down the solution steps. Based on the interview results, S-10 had difficulty using the right formula to solve problem number 5. S-31 wrote down the steps completely using mathematical symbols and terms. Also, he drew the diagram correctly. Based on the interview results, S-31 can also present oral mathematical ideas.

The results of the analysis of visual students' MCS on the third indicator are as follows. Based on the test results, S-10 can solve everyday problems related to geometric rows well and do the calculations well to get the right results. Likewise, S-31 can write the formula concept used and perform calculations appropriately. Based on the interview results with S-10 and S-31, these students can express mathematical ideas well.

The results of the analysis of visual students' MCS on the fourth indicator are as

follows. Based on the test results, S-10 can answer correctly the description related to the arithmetic sequence and give the right reason. Whereas in the description related to the geometric sequence, S-10 could not mention the sequence pattern correctly. As for S-31, he could answer correctly and give the right reason for the description related to geometric rows. In the description related to the arithmetic sequence, S-31 only gave the right reason without writing the sequence pattern. Based on the results of the interview, this is because students have difficulty distinguishing between arithmetic and geometric row patterns.

- Data Display and Conclusion

Tabel 3. Analysis MCS Visual Learning Style Students

Indicator MCS	Test Results	Causes of Difficulty
MCS 1	The pattern of the line formed is still incorrect, and the known information is not written.	There is a lack of accuracy in counting the number of balls in the picture problem.
MCS 2	S-10 only drew the population growth diagram without writing the solution steps. S-32 can solve everyday problems related to geometric series well and correctly draw the population growth diagram.	Difficulty using the right formula to solve problem number 5
MCS 3	Students use the right formula concept to solve everyday problems related to geometric rows.	
MCS 4	Students can give the right reasoning for the description related to the row pattern. However, they are still confused about how to distinguish the concept of the row pattern.	Difficulty in understanding the concept of a sequence pattern.

Based on Table 3, it can be concluded that the mathematical communication skills of visual students in each indicator are as follows. (1) S-10 and S-31 **can less** connect real objects and images to mathematical ideas. (2) S-10 **could not** use the right formula to solve everyday problems. In contrast, S-31 could use the right formula, perform calculations well, and present mathematical ideas orally and in writing to solve everyday problems. (3) S-10 and S-31 **could** use the right formula concept and perform calculations well in solving everyday problems. (4) S-10 and S-31 **could** complete a description or paragraph related to mathematics using their language. However, the students had difficulty understanding the concept of the pattern of a sequence.

Auditorial Learning Style

- Data Reduction

The results of the analysis of the MCS of auditorial students on the first indicator, namely connecting real objects and images into mathematical ideas, are as follows.

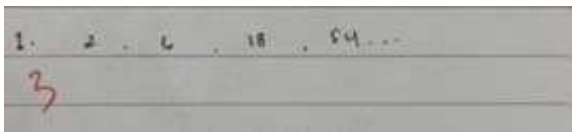

Figure 4. Subject S-1's Result Problem 1

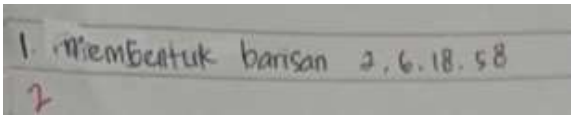

Figure 5. Subject S-32's Result Problem 1

Based on Figure 4 and Figure 5, it can be seen that S-1 and S-32 did not write the known information completely. S-1 only formed the lineup correctly. Whereas S-32 the line formed is less precise. Based on the interview results, S-1 can connect the picture to mathematical ideas well, while S-32 is less careful in reading the picture. The following is also an interview excerpt from one of the students, S-1.

R	*:" <u>What information do you think you got from question number one?</u>"*
S-1	*:" There are four groups of balls that vary in number, Miss"*
R	*:" Tell me the number of each group."*
S-1	*:" The first group has 2 balls, the second group has 6 balls, the third group has 18 balls, the fourth group has 54 balls."*
R	*:" Yes, that's right. Why didn't you write the known information on the answer sheet?"*
S-1	*:"Hehe stand for, Miss"*

The analysis results of auditorial students' MCS analysis on the second indicator are as follows. Based on the test results, S-1 and S-32 can solve contextual problems related to geometric rows well and correctly draw population growth diagrams. Based on the interview results, subject students S-1 and S-32 can explain their answers in detail.

The analysis results of auditorial students' MCS analysis on the third indicator are as follows. Based on the test results, S-32 used the correct formula concept in solving everyday problems related to geometric rows and performed calculations well. The interview with S-32 also shows that students can express mathematical ideas well. Meanwhile, S-1 incorrectly used the formula concept. Based on the interview results, S-1 was wrong to understand the concept of the formula.

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The analysis results of auditorial students' MCS analysis on the fourth indicator are as follows. Based on the test results, S-1 did not answer the row pattern formed from the description question related to arithmetic rows and incorrectly mentioned the row pattern on the description question related to geometric rows. S-23, on the other hand, could mention the row pattern and give the right reason on the description question relating to arithmetic rows. It incorrectly mentioned the row pattern but correctly gave the reason on the description question relating to geometric rows. Based on the interview results, S-1 and S-32 had difficulty understanding the row material.

- Data Display and Conclusion

Table 4. Analysis MCS Auditorial Learning Style Students

Indicator MCS	Test Results	Causes of Difficulty
MCS 1	S-1 and S-32 did not write down the known information. S-1's sequence pattern is still inaccurate, but S-32 can form the right line pattern.	There is a lack of accuracy in counting the number of balls in the picture problem.
MCS 2	S-1 and S-32 can solve everyday problems related to geometric rows and can also draw the population growth diagram well.	
MCS 3	S-32 can use the right formula concept to solve everyday problems related to geometric rows, while S-1 was wrong to use the formula.	Incorrect understanding of the concept of the formula.
MCS 4	S-1 could not mention the line pattern correctly and gave inaccurate reasons. Meanwhile, S-32 could give the right reason. However, it was wrong to mention the pattern of the row.	Difficulty in understanding the concept of a sequence pattern.

Based on Table 4, it can be concluded that the mathematical communication skills of auditorial students in each indicator are as follows. (1) S-1 and S-32 **could** connect pictures to mathematical ideas well. However, S-1 was less careful in calculating the number of balls in the picture problem. (2) S-1 and S-3 **could** use mathematical symbols and terms when presenting mathematical ideas well. They used the right formula and did the calculation well. (3) S-32 **could** use the right formula concept and do the calculation well. However, S-1 was less able to use the right formula in solving everyday problems. (4) S-1 and S-32 **were less able** to solve descriptions related to mathematics. Students had difficulty in distinguishing the concept of a sequence.

Read/ Write Learning Style

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- Data Reduction

The results of the analysis of students' reading/writing MCS on the first indicator are as follows:

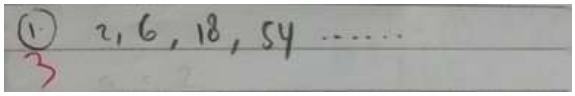

Figure 6. Subject S-9's Result Problem 1

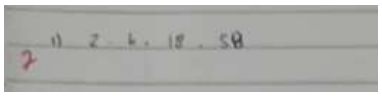

Figure 7. Subject S-21's Result Problem 1

Based on Figure 6, S-9 did not write down the known information but could form the row correctly. As for Figure 7, S-21 did not write down the known information, and the row formed was not correct. Based on the interview results, S-9 can connect the picture to mathematical ideas well, while S-21 is less focused on observing the picture. An interview excerpt from one of the students, S-21, is also attached.

R	*:" What do you think this picture means?"*
S-21	*:" There are four groups of balls with different amounts, Miss"*
R	*:" What information can be taken from this question?"*
S-21	*:" The number of balls in each group is different, Mum. The first group has 2 balls, the second group has 6 balls, the third group has 18 balls, and the fourth group has 58 balls."*
R	*:" What mathematical ideas do you think can be used to answer this question?"*
S-21	*:" The number of balls makes a row, Miss. The line is 2, 6, 18, 58."*
R	*:" Are you sure your answer is correct?"*
S-21	*:"Sure, Miss"*
R	*:"What's the reason?"*
S-21	*:" Because I've counted the balls, Miss"*
R	*:"Take a look again"*
S-21	*:" Astaghfirulloh sorry, Miss. I wasn't focused enough on counting the balls. Group four should have 54 balls"*
R	*:" Be more careful."*

The results of the analysis of students' reading/writing MCS on the second indicator are as follows: Based on the test results, S-9 did not find any mathematical ideas to solve the problem. Likewise, S-21 only drew a diagram without writing the solution steps. Based on the interview results, this happened because the subject did not know the steps to solve the problem well and still just answered.

The analysis results of students' reading/writing MCS analysis on the third indicator are as follows: Based on the test results, S-21 used the right formula concept

and did the calculations well. The results of the interview with S-21 can help understand the solution steps well. Meanwhile, S-9 was wrong in using the formula concept. So that the results obtained are less precise. Based on the results of the interview, this happened because S-9 was confused in using the formula following question number 4.

The results of the read/write students' MCS analysis on the fourth indicator are as follows. Based on the test results, S-9 can correctly mention the pattern of the rows formed and can give the right reasons. The results of the interview with S-9 can also present mathematical ideas using his language. In contrast to S-21, S-21 incorrectly mentioned the sequence pattern in the description question related to arithmetic and geometry sequence. Based on the interview results, S-21 had difficulty distinguishing the concept of arithmetic and geometric sequence patterns.

- Data Display and Conclusion

Table 5. Analysis MCS Read/ Write Learning Style Students

Indicator MCS	Test Results	Causes of Difficulty
MCS 1	S-9 and S-21 did not write down the known information. The row pattern formed by S-21 is still not correct. While S-9 can form the right row pattern	There is a lack of accuracy in counting the number of balls in the picture problem.
MCS 2	S-9 and S-21 were unable to solve everyday problems related to geometric rows.	Difficulty getting ideas in solving the problems contained in the problem.
MCS 3	S-21 can use the right formula concept in solving everyday problems related to geometric rows. While S-9 was wrong in using the formula	Incorrect in understanding the concept of the formula
MCS 4	S-9 and S-21 were able to give the right reasons and gave the correct answers.	

Based on Table 5, it can be concluded that the mathematical communication skills of read/write students on each indicator are as follows. (1) Students **can** connect pictures to mathematical ideas. However, some students are still less careful in calculating the number of balls contained in the pictorial problem, as done by S-21. (2) S-9 and S-21 **were less able** to solve contextual problems. Students do not have ideas in solving the problems contained in the problem. (3) S-21 **can** use the right formula concept and perform calculations well. While S-9 was less able to determine the right formula to use to solve everyday problems. (4) S-9 and S-21 **were able** to complete a description or

paragraph related to mathematics using their language. However, they had difficulty understanding the concept of the pattern of a sequence.

Kinesthetic Learning Style

- Data Reduction

The results of the analysis of kinesthetic students' MCS on the first indicator, namely connecting real objects and images into mathematical ideas, are as follows.

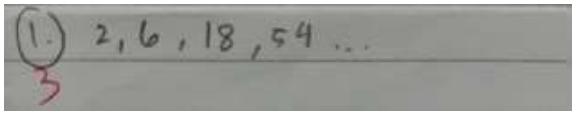

Figure 8. Subject S-15's Result Problem1

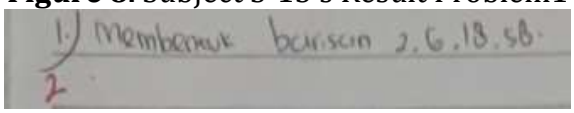

Figure 9. Subject S-12's Result Problem1

In Figure 8 and Figure 9, S-15 and S-12 did not write the complete known information in the realistic problem. S-15 only answered by writing the pattern of the line formed correctly. Meanwhile, S-12 was still inaccurate in writing the line formed. Based on the interview results, S-15 could present the mathematical ideas from the picture well, while S-12 was less careful in observing the picture. An interview excerpt from one of the students, S-15, is also attached.

R :*" What information do you get from the picture of question number one?"*
S-15 :*" Number of balls, Miss"*
R :*" How many balls?"*
S-15 :*" The number of balls in group one is 2, if group two is 6, group three is 18, group four is 54, Miss"*
R :*" That's the information you got from the picture?"*
S-15 :*"Yes, Miss"*
R :*" Why don't you write it on the answer sheet?"*
S-15 :*" Because I'm too lazy to write a lot, Miss."*
R :*" Then how do you think you can solve this problem?"*
S-15 :*" Just sort it out, Miss. The question asks to make a row, so the row is 2, 6, 18, 54"*

The results of the analysis of kinesthetic students' MCS on the second indicator are as follows. Based on the test results, S-15 did not find mathematical ideas to solve contextual problems related to geometric rows. Based on the interview results, S-15 did not know the solution steps well. In contrast to S-12, who could solve everyday problems related to geometric rows well and draw the population growth diagram correctly. Based on the interview, S-12 could also present mathematical ideas verbally.

The results of the analysis of kinesthetic students' MCS on the third indicator are as follows. Based on the test results, S-15 was wrong to use the formula concept. Based on the results of interviews conducted with S-15, the subject was confused when applying the right formula to a problem. Meanwhile, S-12 could solve the contextual problem by using the right formula concept and doing the calculation well. The results of the interview with S-12 also explained the solution steps well.

The results of the analysis of kinesthetic students' MCS on the fourth indicator are as follows. Based on the test results, S-15 could mention the line pattern correctly and give the right reason on the description question related to the line pattern. Based on the interview results, S-15 can also express mathematical ideas using his language. S-12, on the other hand, could only answer question number 2 correctly and incorrectly mentioned the line pattern formed in question number 3. Based on the interview results, S-12 had difficulty understanding the basic concept of line patterns.

- Data Display and Conclusion

Based on Table 6, it can be concluded that the mathematical communication skills of kinesthetic students on each indicator are as follows. (1) S-15 and S-12 **connected** pictures to mathematical ideas. However, S-15 was less careful in calculating the number of balls in the pictorial problem. (2) S-15 **was less able** to present mathematical ideas both orally and in writing when solving everyday problems, in contrast to S-12, who could present mathematical ideas when solving everyday problems well orally and in writing. (3) S-12 **could** express mathematical ideas and perform calculations well in solving everyday problems, unlike S-15, who could not determine the right formula concept in solving everyday problems. (4) Students **were able** to solve descriptions related to mathematics using their language. It's just that there are still students who have difficulty distinguishing the concept of row patterns.

Table 6. Analysis MCS Kinesthetic Learning Style Students

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Indicator MCS	Test Results	Causes of Difficulty
MCS 1	S-15 and S-12 did not write down the known information. The sequence pattern formed by S-15 is still not correct. Whereas S-12 can form the right line pattern	There is a lack of accuracy in counting the number of balls in the picture problem.
MCS 2	S-15 could not solve everyday problems related to geometric rows. On the other hand, S-12 could solve everyday problems related to geometric ranks.	Doesn't know the solution step well.
MCS 3	S-12 can use the right formula concept in solving everyday problems related to geometric rows. While S-15 was wrong in using the formula	confusion when applying the right formula to a problem.
MCS 4	S-9 and S-21 were able to give the right reasons and gave the correct answers.	

Discussion

Based on the ***Results*** section, two research results were obtained, namely (1) the most dominant percentage of mathematical communication in each learning style group was in the third indicator and (2) the most dominant cause of difficulty in working on mathematical communication problems in each learning style group was lack of accuracy.

To get the first research results, Table 2 and Table 7 below were also used.

Table 7. Interpretation Table

Interpretation	Percentage
Whole	100%
Almost The Whole	76-99%
Most of the time	51-75%
Half	50%
Almost Half	26-49%
A Small Part	1-25%
Not One	0%

Based on Table 2, the marginal mean column and Table 7, it can be said that in each learning style group, almost all students can work on all MCS indicators. Furthermore, Table 2 shows that the most dominant percentage of mathematical communication ability in each learning style group is in the third indicator, namely expressing mathematical ideas in solving everyday problems.

 http://doi.org/10.30762/f_m.v7i1.1832

The above research is supported by research conducted by Novferma, Mujahidawati, and Setiana (2021), which suggests that groups of students with visual, auditorial, read/write, and kinesthetic learning styles have relatively the same mathematical communication skills. Based on the explanation above, there is no direct link between the selection of learning style type and mathematical communication ability.

Still related to the results of the first study, namely the highest percentage of learning success for each learning style group was achieved in the third MCS indicator, Labina and Resi (2020) mentioned that students taught with realistic mathematics learning models tend to be able to express mathematical ideas well in solving realistic problems. Based on the explanation above, it can be concluded that the realistic mathematics learning model can train students' activities on the third indicator of mathematical communication ability.

Sibarani, Simanjorang, and Mukhtar (2022) supported the results of the second study. They showed that a lack of accuracy is one of the causes of difficulties that students tend to experience in solving MCS problems. Based on the explanation above, it can be concluded that inaccuracy causes students' difficulties in solving mathematics problems, especially mathematical communication problems, and does not depend on the type of learning style.

CONCLUSION

Two conclusions were obtained based on the discussion section. The first conclusion is that the most dominant percentage of mathematical communication in each learning style group is in the third indicator: expressing mathematical ideas in solving everyday problems. The second conclusion is that various causes of students' difficulties working on mathematical communication problems exist. However, the most dominant factor for each learning style group is the same: lack of accuracy.

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CONFLICT OF INTEREST

We have no conflicts of interest to disclose.

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AUTHOR CONTRIBUTIONS

Indika Irkhamni: Conceptualization, writing - original draft, writing - review & editing , and methodology;

Muhammad Najibufahmi: Validation and supervision.

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