

Analysis of Mathematical Communication Ability in Solving Story Problems Based on Mathematical Ability and Gender

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ABSTRACT

This study aims to test the written mathematical communication skills of students who study mathematics material about cubes and blocks at SMP 238 Jakarta. This study uses a qualitative descriptive methodology. Data collection using tests and interview. As a test of the validity of the data using the triangulation technique was carried out by comparing the results of the subject's mathematical communication ability test with the results of the interview. The subject of this study were students of class VIII SMP 238 Jakarta, totaling 6 students who were divided into 3 groups based on high, medium, and low level of mathematical ability. This study uses 3 indicators, namely explaining mathematical ideas, situations and relationships/in writing, explaining mathematical ideas in the form of visual images/tables/diagrams, explaining ideas of problem situations picture or real objects into the language of symbols of mathematical models/mathematical expressions. This study revealed that students with high level of mathematical ability were able to answer questions on indicators 1, 2, and 3. Subjects with low level of mathematical ability were able to answer questions on indicators 1, 2, and 3 but still did not understand and were still in complete the method used in answering.

Keywords : Mathematical Communication Skills, Math ability, and Gender.

ABSTRAK

Penelitian ini bertujuan untuk menguji kemampuan komunikasi matematis secara tertulis peserta didik yang mempelajari materi tentang kubus dan balok di SMP 238 Jakarta. Penelitian ini menggunakan metodologi deskriptif kualitatif. Pengumpulan data menggunakan teknik triangulasi dilakukan dengan membandingkan hasil tes kemampuan komunikasi matematis subjek dengan hasil wawancara. Subjek penelitian ini adalah peserta didik kelas VIII SMP 238 Jakarta, yang berjumlah 6 peserta didik yang dibagi menjadi 3 kelompok berdasarkan kemampuan matematika tingkat tinggi, sedang, dan rendah. Penelitian ini menggunakan 3 indikator, yaitu menjelaskan ide, situasi dan relasi matematika secara tulisan, menjelaskan ide matematika dalam bentuk visual gambar/tabel/diagram, menjelaskan ide situasi masalah gambar atau benda nyata ke dalam bahasa simbol model matematika/ekspresi matematika. Penelitian ini mengungkapkan bahwa peserta didik dengan kemampuan matematika tingkat tinggi mampu menjawab pertanyaan pada indikator 1, 2, dan 3. Subjek dengan kemampuan matematika tingkat rendah mampu menjawab pertanyaan pada indikator 1, 2, dan 3, tetapi masih belum paham dan masih belum lengkap cara yang digunakan dalam menjawab.

Kata kunci: Kemampuan Komunikasi Matematis, Kemampuan Matematika, dan Gender.

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PRELIMINARY

Learning is a conscious effort by the teacher to make students learn. That is, there is a change in the behavior of students that has been going on for a relatively long time. Based on the efforts of students, students learn when there is a change in behavior, learn from strangers, empower the incompetent, and empower the incompetent. experienced (Asih, 2020). Education is where you get knowledge and skills to deal with all the problems encountered in everyday life (Yurniwati & Hanum, 2017). Learning and education is interrelated, and the government designs educational goals to ensure that learners have strict strength, calmness, character, insight, respectable people and skills needed, society, and the country. Teachers have an obligation to achieve these educational goals. The way the teacher communicates that students have these skills occurs in the learning process.

Communication in mathematics learning is an approach to exchange ideas and explain the understanding of the substance of the illustration, and based on thoughts In this case, learning must be made possible through conversation, progress, and enhancement. Relational skills empower students to investigate and strengthen mathematical reasoning by building excellent oral or written mathematical reasoning and by using the language of mathematics to deal with these problems (Annisa & Siswanto, 2021).

National Council of Mathematical Teachers (NCTM) Define five mathematical abilities: critical thinking ability, arithmetic thinking ability, numerical association ability, numerical relational ability, and numerical articulation capacity. Numerical relational ability is one of the numerical capacities that plays an important role in helping members of the student structure open people who can deliberately and clearly convey thoughts for local improvement. Numerical Correspondence capacity also builds students' assets in deciding which ideas and methodologies are appropriate for dealing with numerical problems. (Rohman, 2018).

Mathematical communication skills are an important part of interaction mathematics learning. Mathematical communication skills help candidates learners develop their mathematical information and it is very valuable in everyday life (Kurniawan et al., 2017). Communication skills students' mathematics alludes to how students give

their thoughts, effectively taking part in conversations, and answer the problem to solve the problem given by the teacher. Using a metacognitive approach, utilizing critical thinking, utilizing the *Collaborative Integrated Reading and Writing* (CIRC) model, utilizing the *Contextual Teaching and Learning* (CTL) model, utilizing PMR and heuristic picking up, learning through learning (Putra, 2016).

Mathematics is a theoretical science with thinking that requires rationality emerges through critical thinking exercises (Taubah, 2018). Thus, mathematics It's not a math-related class, it's an interaction of thoughts which requires rationality. Mathematics is one of the compulsory subjects at the level of further education in basic training. Mathematics can form valid, basic, innovative, and orderly reasoning (Putri, 2018).

In mathematics, a concept is an idea formed by looking at the properties general of a set of corresponding copies. Identify concepts based on the presence of a copy set. When more than one copy of an idea can be found, it is called draft. math is different from other subjects, and by default, math is an abstract subject. For example, abstraction in mathematics is use of symbols. this causes many students to have difficulty learning in fields related to numbers (Agnesti & Amelia, 2020).

Mathematical ability is the capacity to perform mental exercises such as reasoning and thinking, and making use of all basic information to take care of mathematical statements. Students' mathematical abilities fluctuates and is classified by level. different levels of capacity to connect with decisive reasoning (Men, 2017).

Gender is defined as an attribute related to the description the roles, behaviors, gender, and characteristics of men or women in culture certain. Gender can differentiate communication skills and express ideas and communication methods. male and female students tend to have different communication skills to express their thoughts when facing problems (Annisa & Siswanto, 2021). From the existing studies, the novelty of this research is mathematical communication skills in solving story problems based on mathematical abilities and gender.

METHODS

This study uses a qualitative descriptive method with the aim of testing mathematical communication skills. Denzin and Lincoln (Shidiq and Choiri, 2019) Qualitative research is a logical exploration with the intention of describing distinctiveness through words by incorporating perceptual strategies, encounters, and contextual analysis. In this review, researchers will describe the ability of mathematical communication of

students in dealing with story problems in terms of mathematical abilities and gender. The following research flow chart is made to describe the research plan in depth, which can be seen as follows.

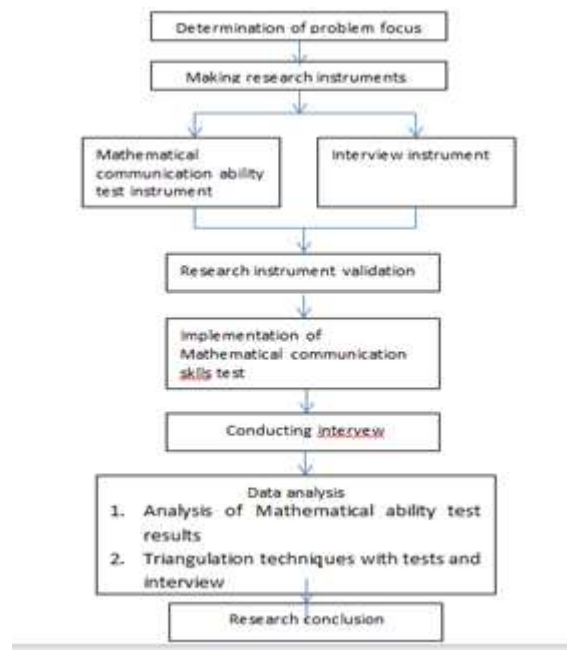


Figure 1. Flowchart of research methods

In the figure above shows the research flow chart of the research method used. The subjects of this study were students of class VIII at SMPN 238 Jakarta, which amounted to up to 6 students in terms of high, medium and low mathematical abilities.

Data collection through exams and interview results. test instrument given a means to measure students' mathematical communication skills. Theory on the test questions are about the flat shapes of cubes and blocks. Interview conducted to see if there is a difference in students providing verbal data recorded as a hard copy. The interview material is about the results of the answers on the test questions that have been completed.

This study involved 6 students, namely, two students with high numerical capacity, two students with moderate mathematical capacity, and two learners with low numerical capacity. triangulation procedures, specialist will use various information gathering strategies to obtain similar information. In this review, the researcher will use a test instrument and interviews to get the result of each student's score.

RESULTS AND DISCUSSION

Story test questions about blocks and cubes are given to 6 participants students in class VIII SMPN 238 Jakarta, then at that time the researchers really saw the length of work and the scores obtained from each student, this is complete for students to see into

the category of high-level mathematical ability, medium, and low to fit the size and meet the prerequisites. The story test questions resulted in 6 students, then, the researcher chose 6 students as subjects consisting of 1 male student and 1 female student with a high level of mathematical ability, 1 male student, and 1 female student with ability moderate level of mathematics, 1 male student, and 1 female student with low level math ability.

The researcher gave 3 questions to the students regarding the Mathematical Communication Skills Test (TKKM) question according to the marker is not completely settled for the 6 selected questions. test and interviews are directed using the Zoom application, because this examination carried out during the coronavirus pandemic. test result information is information Mathematical Communication Skills Test (TKKM) test results and information on interview results. Attached will be introduces information from tests and interviews structured with tests of mathematical communication skills.

Table 1. Research Subject Category

No.	Name	Score
1.	FPW	23
2.	BRT	21
3.	ZS	19
4.	ZAM	18
5.	RN	15
6.	AZ	13

Research subjects categorized in each ability mathematics, then do as many as 6 questions with cube and block material. The following is the data of the informants in this study.

Table 2. Research Informant Data

Student Code	Category
S1	High
S2	High
S3	Medium
S4	Medium
S5	Low
S6	Low

After deciding on the information of the informant's data, then checking the results of the answer tests from students who studied the cube and block material as seen from math skills. Next are the test results and student interviews.

Data analysis

Points from indicator 1 there are 2 questions about Mathematical Communication Skills Test (TKKM) regarding Understanding ideas, circumstances, and mathematical connections/relationships in writing. Replies regarding indicator question 1, question number 1 of S1 is shown the results of the answers on Figure 1 and the interview section of question number 1 for S1.

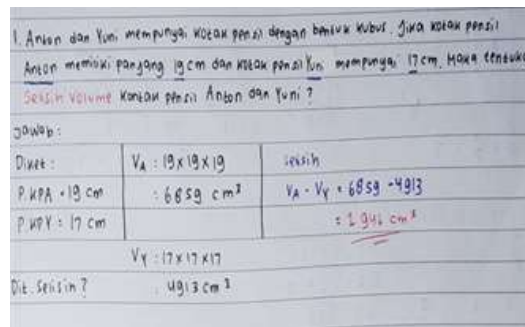


Figure 1. Answers to Question 1 Indicator Question Number 1 of S1

Considering the answer given by S1 in Figure 1, the researcher interviewed S1.

Researcher : “Do you understand question No.1 ?”

S1 : “Already”

Researcher : “If you understand question No.1, please explain again what is meant in the question.”

S1 : “On question no 1, we have to find the difference in the volume of Anton’s pencil case and Yuni’s pencil case(kubus).”

First, we find the volume of Anton’s pencil case :

$$\text{Volume} = 19 \times 19 \times 19 = 6859 \text{ cm}^3$$

Second, we find the volume of Yuni’s pencil case:

$$\text{Volume} = 17 \times 17 \times 17 = 4913 \text{ cm}^3$$

The volume of Anton’s pencil case minus the volume of Yuni’s pencil case

$$\begin{aligned} V_A - V_Y &= 6859 - 4913 \\ &= 1.946 \text{ Cm}^3 \end{aligned}$$

Researcher : “Are you sure about your answer on No. 1 this ?”

S1 : “Convinced”

Researcher : “Well, what do you actually know about the volume of a cube ?”

S1 : “The volume of a cube is a geometric figure which is bounded by 6 sides (square) which have length, width and height and the contents can be calculated in it.”

Remembering the interview results from the first pointer question number 1 for S1, it seems that there are no blunders experienced by S1, meaning that S1 is now ready to

arrange cubes and blocks into story problems and is ready to solve them. then, the responses that are composed of indicator 1 for question number 2 of S2 are shown the results of the answers in Figure 2 and section interview from question number 2 for S2.

2	$V \text{ kubus} = s \times s \times s$	Jumlah potongan-potongan kayu =
	$= 30 \times 30 \times 30$	$27.000 \times 5 = 135.000 \text{ cm}^3$
	$= 27.000 \text{ cm}^3$	

Figure 2. Answers to Question 1 Indicator Question Number 2 of S2

Based on the results of the answers to the Mathematical Communication Skills Test (TKKM) questions arranged in Figure 2, it can be seen that Masters can understand and describe mathematics both orally and in written form. Considering the response given by S2 to Figure 2, the researcher interviewed S2.

Researcher : “Okay, next one, for No.2, what did you answer ?”

S2 : “Answer”

Researcher : “Do you understand this question No.2 ?”

S2 : “Understood”

Researcher : “Try to explain again what is meant by question No.2 !”

S2 : “The length of the wooden edge is 30 cm, then the volume of the cube $30 \times 30 \times 30 = 27.000^3$ then multiplied by $5 \times 27.000 = 135.000 \text{ cm}^3$ ”

Considering the results of the interview question number 2 for S2, it is very good to see that there are no errors experienced by S2 in describing mathematical thinking both orally and in writing, meaning that S2 has the option to arrange blocks and cubes on the mathematical model through given image.

The second indicator there are 2 questions about Mathematical Communication Skills Test (TKKM) regarding capacity indicators numerical correspondence, Understanding numerical thinking in visual structures (picture, table, or chart). Compiled answers to questions Indicator 2 question number 3 of S3 is introduced in Figure 3 and part of the interview question Indicator 2 of question number 3 is for S3.

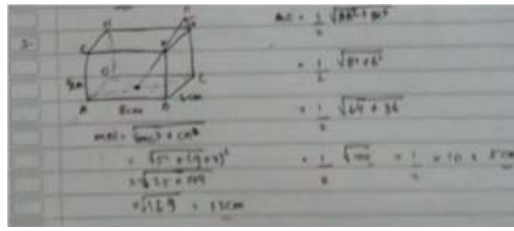


Figure 3. Answers to Question 2 Indicator Question Number 3 of S3

Based on the results of the answers to the Mathematical Communication Skills Test (TKKM) test questions answered by S3 in Figure 3, it appears that S3 has the option to take advantage of Understanding thinking mathematics in visual structures (pictures, tables or charts). Remembering feedback it was given S3 in Figure 3, the researcher interviewed S3.

Researcher : “Do you understand what is meant by question No.3 ?”

S3 : “Understood”

Researcher : “Okay, after you understand the meaning of question No. 3, what method do you choose to do the problem ?”

S3 : “The way to find the length of my MN is using a right triangle

$$\text{Length NC} = \text{CG} + \text{GN} = 9 + 3 = 12 \text{ cm}$$

then the length of MC = $\frac{1}{2}$ AC.

First we find the length of AC ie

$$\text{AC}^2 = \text{AB}^2 + \text{BC}^2, \text{AC}^2 = 8^2 + 6^2, \text{AC}^2 = 100, \text{AC} = 10 \text{ cm.}$$

Then we find the length of MC, $\text{MC} = \frac{1}{2} \text{AC} = \frac{1}{2} \times 10, \text{MC} = 5 \text{ cm.}$

$$\text{Then we find MN, } \text{MN}^2 = \text{MC}^2 + \text{NC}^2 = 5^2 + 12^2$$

Then we break it down to $25 + 144$ the result is $\text{MN}^2 = 169$

Combined into $\text{MN} = 13 \text{ cm}''$

Remembering the interview part of the indicator question 2 question number 3 for S3 it is very clear that there have been no blunders experienced by S3 in deciphering mathematics both orally and in writing. Lack of strategy cara used in dealing with this problem. In addition, the answers are composed of indicator questions 2, question number 4 of S4 is shown in Figure 4 and the results of the S4 interview, question number 4 for S4.

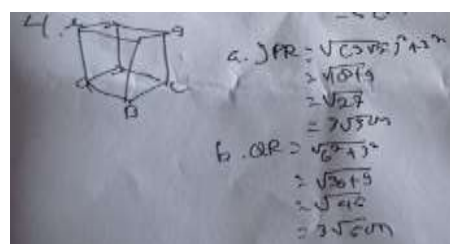


Figure 4. Answers to Question 2 Indicator Question Number 4 of S4

Based on the answers to the Mathematical Communication Skills Test (TKKM) questions compiled by S4 in Figure 4, shows that S4 can use the Arithmetic Mind Teaching in visual structure (pictures, tables or diagrams). Considering the feedback given by S4 in Figure 4, the researcher interviewed S4.

Researcher : “For No.4 what do you know about this No ?”

S4 : “Determine the distance between point P to point R and, point Q to point R”

Researcher : “Oh okay, if I may ask you to do using What kind of concept or event is that? Can you try to explain it?”

S4 : “First I look for AR which results is $3\sqrt{2}$ cm.

Second, I searched for PR by using the Pythagorean formula

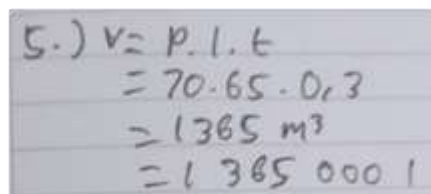
$PR^2 = AP^2 + AR^2$ which results in $3\sqrt{3}$ cm.

Thirdly I searched the QR by using the pythagorean formula $QR^2 = RO^2 + QO^2$ which results is $3\sqrt{5}$ cm”

Researcher : “Are you sure about your answer ?”

S4 : “Sure”

Considering the results of the interview from the indicator question 2, question number 4 for S4, it is very noticeable that there is no slip-up experienced by the S4 in deciphering numerical thinking both orally and in writing, but the picture is less clear making it difficult to see and fragmented techniques are utilized in dealing with problem. Indicator 3 there are 2 questions about Matemactical Communication Skills Test (TKKM) about capacity indicators Understanding thoughts, problem states, pictures or original items into picture language, numerical model/numerical articulation. Compiled answers to questions indicator 3 number 5 of S5 is introduced in Figure 5 and the interview section Indicator 3 question number 5 for S5.



Handwritten calculation showing the volume of a rectangular prism (P. l. t):

$$\begin{aligned} 5.) V &= P. l. t \\ &= 70 \cdot 65 \cdot 0,3 \\ &= 1365 \text{ m}^3 \\ &= 1\ 365\ 000 \text{ l} \end{aligned}$$

Figure 5. Answers to the 3rd Indicator Question Question Number 5 of S5

Considering the results of the answers to the Matemactical Communication Skills Test (TKKM) questions from S5 in Figure 5, it shows that S5 can use the term, Understanding thoughts, states of issuing image or original item into image language, numeric/articulated model numeric. considering the responses given by S5 in Figure 5, the researcher interview with S5.

Researcher : “Do you understand what was asked in question No. 5?”

S5 : “Yes, I understand”

Researcher : “Are you sure about your answer?”

S5 : “Sure”

Considering the results of the interview from the indicator questions 3 questions number 5 for S5, it turns out that there are no blunders experienced by S5 in using the term, understand thoughts, problem states, pictures or original items into the language of pictures, models numeric/numeric articulation, This implies that the S5 can handle data that given by making use of showing genuine items in dealing with problems, but completely less complete the technique used in overcoming the problem. Next, answer the indicator question 3 question number 6 of S6 introduced to the results of the 3 indicator questions interview number 6 for S6.

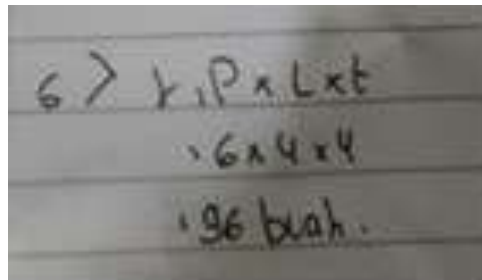


Figure 6. Answers to the 3rd Indicator Question Question Number 6 of S6

Researcher : “Did you answer question No.6 ? If so, can you explain what is the meaning of question number 6?”

S6 : “Answer it please kaa, look for the number of cartons Mr. Win”

Researcher : “In what way did you do question no. 6 this ?”

S6 : “same as question number five method $P \times L \times T = 6 \times 4 \times 4 = 96$ boxes”

Researcher : “Are you sure about your answer ?”

S6 : “sure”

Considering the results of the interview indicator 3 question number 6 for S6, it turns out that there are blunders experienced by S6 in using terms, understanding thoughts, circumstances problem, image or original article into image language, numerical/articulated model numeric, implying that S6 can handle given data with take advantage of describing the original article in dealing with the problem, however completely incomplete way of underused technique in handling problem.

CONCLUSION

Ends from the consequences of exploring and investigating the above information, overall mathematical communication ability subject mathematical ability high, medium, and low levels that are male and female. high-level mathematical ability is superior to ability low-level mathematics that is gendered male and female. Ability female high-level mathematics (S1) are better prepared to communicate and describe numerical thinking and data cycles to deal with numerical problems as the opposite of low-level math skills that are female gender (S5). Male (S2) gender is more high-level mathematical ability fit expresses numerical thinking as opposed to ability low-level mathematics that is male (S6).

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