MATHEMATICAL COMMUNICATION SKILLS IN SOLVING LIMIT AND CONTINUITY PROBLEMS: REVIEWED FROM INTRA-AND-INTERPERSONAL INTELLIGENCE

Ratna Yulis Tyaningsih[1*], Arjudin[2], Nilza Humaira Salsabila[3]

[1,2,3]Department of Mathematics and Education, Faculty of Teacher and Training and Education, Universitas Mataram, Indonesia

Corresponding author: ratnayulis@unram.ac.id

Article Info	ABSTRACT
	The various intelligence of students allows for differences in the mathematical communication skills produced. This study aimed to analyze students' mathematical communication skills in terms of intrapersonal and interpersonal intelligence. The subjects of this study were students of Mathematics Education Class IV at the University of Mataram. This research method is descriptive with a survey design. This study uses a qualitative approach with stages covering problem formulation, sample selection, research limitations, instrumentation in the form of questionnaires and tests, data collection and analysis, and conclusion. The results of this study indicate that the level of intrapersonal and interpersonal intelligence affects students' mathematical communication skills. This can provide information to educators to provide appropriate services.

KETERAMPILAN KOMUNIKASI MATEMATIS DALAM MENYELESAIKAN SOAL LIMIT DAN KONTINUITAS: TINJAUAN DARI KECERDASAN INTRA-DAN-INTERPERSONAL

	ABSTRAK
	Beragam kecerdasan peserta didik memungkinkan terdapatnya perbedaan ketrampilan komunikasi matematis yang dihasilkan. Tujuan penelitian ini adalah menganalisis ketrampilan komunikasi matematis peserta didik ditinjau dari kecerdasan intrapersonal dan interpersonal. Subjek penelitian ini adalah mahasiswa Pendidikan Matematika Kelas IVA di Universitas Mataram. Metode penelitian ini adalah deskriptif dengan jenis survey design. Penelitian ini menggunakan pendekatan kualitatif dengan tahapan meliputi perumusan masalah, pemilihan sampel dan pembatasan penelitian, instrumentasi berupa angket dan tes, pengumpulan dan analisis data, dan penarikan kesimpulan. Hasil penelitian ini menunjukkan bahwa tingkat kecerdasan intrapersonal dan interpersonal mempengaruhi ketrampilan komunikasi matematis peserta didik. Hal ini dapat memberikan informasi kepada pendidik untuk memberikan pelayanan yang tepat.

1.   INTRODUCTION

Humans as social beings have a tendency to always work together, interact, communicate ideas and thoughts with others to solve the problems they face so that it can be said that humans cannot live alone [1], [2]. Likewise, when students are given math problems, students will need a stimulus or help from either educators or other learning resources. In the COVID-19 pandemic situation, educators have transformed, including learning resources that can be obtained free of charge and open access such as e-books, e-learning, LMS, social media, and others [3], [4]. In the learning process, communication can occur through the delivery of information from sources to students and vice versa. When students obtain information in the form of mathematical concepts from these learning resources, there will be a transformation of information from these learning resources to students. Furthermore, students will respond to this information by developing information based on their interpretation [5], [6]. This will lead to new findings and further understanding of mathematical concepts. A further communication process occurs when participants are faced with a real experience about the application of mathematics in everyday life, then it will make learning mathematics a more useful and meaningful activity that emphasizes reasoning rather than memorizing mathematical formulas [7], [8].

Mathematical communication ability is one aspect of skills that play an important role in supporting student learning success. There are six abilities that students need to have in learning mathematics, including conceptual understanding, problem-solving, reasoning and proof, communication, connection, and representation [9]. Mathematical communication skills help students convey ideas and describe mathematical concepts to other students through mathematical communication activities. The mathematical communication activities in question can be in the form of questions and answers, discussions, quizzes, investigations/observations, presentations, and interviews. Through mathematical communication activities, students can build their concepts and can convey them to others in a clear and structured manner [10]. The following are some indicators of mathematical communication skills in solving mathematical problems, including 1) reading, translating codes/codes, understanding statements, questions, tasks, objects, or images to form a mental model of the situation, 2) articulating solutions, showing the work used in reaching solutions and summarizing and or presenting mathematical results, 3) constructing and communicating explanations and arguments in the context of the problem [11]. Meanwhile, three important aspects are assessed in communicating: accuracy, completeness, and fluency in conveying information [12]. In detail, the indicators and aspects of the assessment of mathematical communication skills are presented in Table 1.

High or low students' mathematical communication skills are determined by several factors, one of which is the difference in intelligence possessed by each student. In humans, there is a wide spectrum of intelligence. The spectrum of intelligence includes seven types of intelligence, namely verbal, visual, logical-mathematical, musical, kinesthetic, intrapersonal, and interpersonal intelligence [13]. In this study, the intelligence chosen to classify mathematical communication skills is intrapersonal and interpersonal intelligence. The level of intrapersonal and interpersonal intelligence possessed by students can provide additional information for educators to implement appropriate classroom learning. Intrapersonal intelligence is related to the ability to understand oneself and be responsible for oneself. Meanwhile, interpersonal intelligence is the ability to relate to other people around him [14]. A similar opinion says that intrapersonal intelligence is related to the ability to objectively analyze oneself, while interpersonal intelligence is related to social intelligence, namely the ability to create a good social environment to observe differences between other individuals, especially in terms of their moods, temperaments, motivations,

and intentions [15]. These two bits of intelligence are interrelated and important for students to have. This intelligence is two of the nine bits of intelligence, the findings of Howard Gardner, which support the implementation of 1 of the 6 pillars of education mandated by UNESCO, namely learning to live together [16].

Interpersonal intelligence plays an important role in education. Educating students in the 21st century requires a different approach because students learn with the sophistication of technology that is constantly changing and evolving. Students need to be critical, creative, problem solvers, good communicators and can work well with peers. In this case, interpersonal intelligence is needed to achieve all these skills [17]. Some characteristics of students who have interpersonal intelligence, include being able to build and create new social relationships with others effectively, easily empathize with other people's conditions, maintain social relationships with others effectively, can communicate with others both verbally and non-verbally, mastering communication skills such as listening, speaking, and writing effectively, can solve problems or problems that occur in social relationships with other people [18]. While the characteristics of students with intrapersonal intelligence levels recognize their strengths, weaknesses, limitations, emotional intelligence or moods, desires, motivations, intentions, and goals, as well as self-respect and self-control, are independent, prefer to learn in their way, and tend to be passive in speaking [19].

Based on the results of observations, it was found that mathematics education students have a variety of intrapersonal and interpersonal intelligence. There are 4 categories from the survey results found, namely students with high intrapersonal and interpersonal intelligence, students with high intrapersonal intelligence but low interpersonal intelligence, students with low intrapersonal intelligence but high interpersonal intelligence, and students with low intrapersonal and interpersonal intelligence. Several studies have stated that intrapersonal and interpersonal intelligence affect the way students communicate both verbally and in writing [20], [21]. Students in class IVA have various communication skills, both verbally and in writing. Therefore, researchers want to analyze more deeply related to students' communication skills in terms of their intrapersonal and interpersonal intelligence.

Several previous studies examined the relationship between intrapersonal and interpersonal intelligence and showed that there was a strong relationship between intrapersonal and interpersonal intelligence on student learning outcomes[22], [23]. Meanwhile, other research states that there is a significant influence between emotional intelligence on mathematical communication skills. This means that every increase in students' emotional intelligence will improve their mathematical communication skills [24]. Students with higher emotional intelligence have better mathematical communication skills [25]. The differences between this study and previous studies are 1) the selection of the material tested to assess mathematical communication skills about limit and continuity, 2) analyzing mathematical communication skills using written test answer data and oral interview data, 3) applying scaffolding for students who have difficulty through in-depth interviews until the correct answer is obtained. Based on the problems above, the researcher wants to analyze the mathematical communication skills of students in solving mathematical problems about limits and continuity in terms of intrapersonal and interpersonal intelligence.

2. METHOD

This research method is descriptive with the survey design type. This study uses a qualitative approach with stages including problem formulation, sample selection, research limitations, instrumentation, data collection and analysis, and concluding. [26]. The stages of this research are presented in a diagram as shown in Figure 1 as follows.
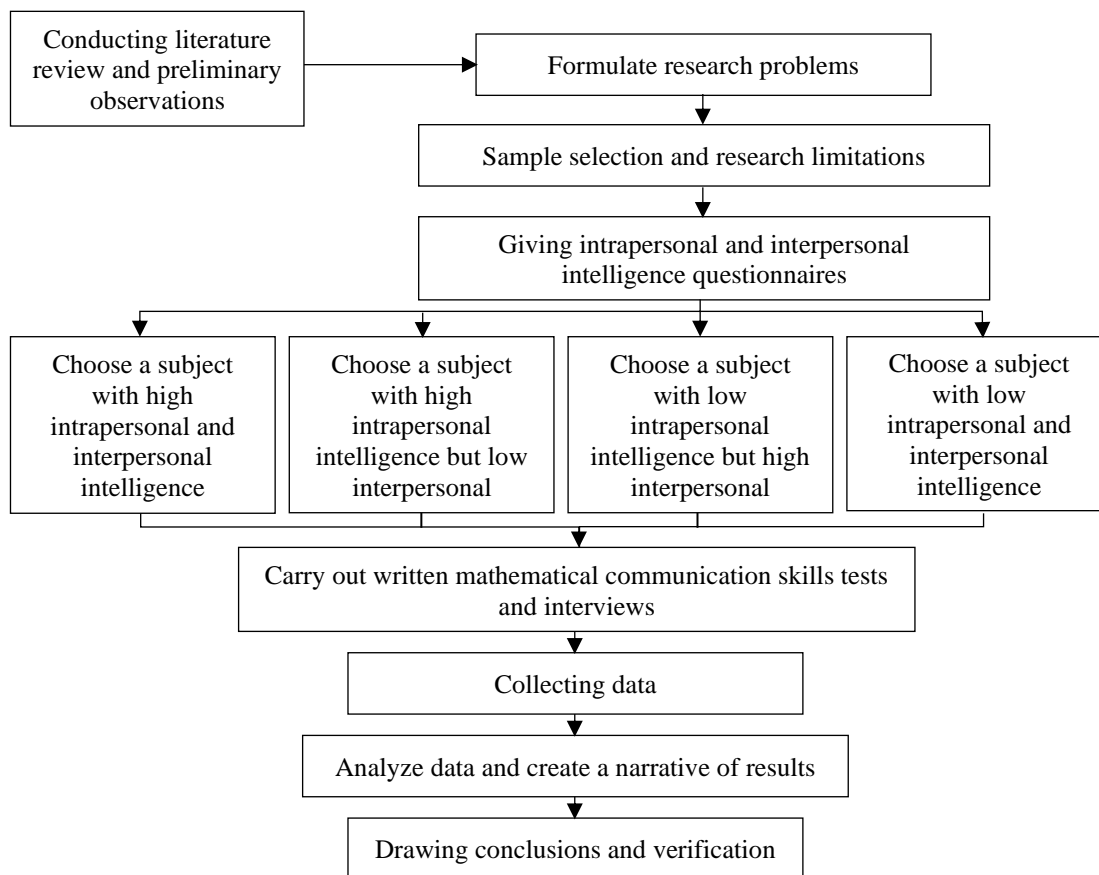

Figure 1. Research Flowchart

Quantitative data in this study were obtained from questionnaires and tests needed to measure students' mathematical communication skills and the level of intrapersonal and interpersonal intelligence possessed. Furthermore, the resulting data were analyzed to examine the relationship between students' intrapersonal and interpersonal intelligence on mathematical communication skills in solving mathematical problems. Indicators of students' mathematical communication skills in full are presented in Table 1 as follows.

Table 1. Mathematical Communication Skill Indicators

No	Mathematical Communication Activities	Aspects of Assessment	Indicator
1	Reading, translating codes or ciphers, understanding statements, questions, tasks, objects, or pictures to form a mental model of a situation.	Accuracy	Write or state what is known and stated in the problem **correctly**.
		Completeness	Write or state everything that is known and asked from the question **completely**.
		Fluency	Write or state what is known and asked without halting and **no scribbling or correction of errors** in the written answer.
2	Articulate the solution and show the work process that occurs in reaching the solution as well as	Accuracy	Write or state the steps for solving the problem using the formula **correctly**.
		Completeness	Write or state **all** the formulas **needed** in solving the problem.

	summarizing and or presenting the mathematical results.	Fluency	Write or state the formulas needed in solving problems **without stuttering and no scribbles or error corrections** in the written answers.
3	Construct and communicate explanations and arguments	Accuracy	Write down or restate the stages of problem-solving that have been done before **correctly**.
	in the context of the problem	Fluency	Write or restate the stages of problem-solving that have been done previously **without halting**.

In this study, the process of delivering material about Limits and Continuity using Google Meet. All student activities in this learning starting from attendance, presentation of teaching materials, discussions/questions and answers via Google Meet video conferences and discussion forums, as well as evaluations/quizzes that can be accessed on the Learning Management System (LMS).

This study aims to analyze students' mathematical communication skills in solving problems in terms of intrapersonal and interpersonal intelligence. The measured mathematical communication skills are divided into two types, namely written and oral. Written communication skills were measured through essay tests, while oral communication skills were measured through observation sheets conducted during interviews [27]. Communication skill levels are classified into three categories, namely high, medium, and low which are presented in Table 2.

Table 2. Classification of Mathematical Communication Skill Levels

Value range	Classification
$P < 65$	Low
$65 \leq P < 80$	Moderate
$80 \leq P \leq 100$	High

Source: Adapted from Wahyuni (2019) [28]

The data collected in this study were in the form of intrapersonal and interpersonal intelligence questionnaire data used for the selection of research subjects, data on written test results, and interview tests to measure mathematical communication skills. The results of the intrapersonal and interpersonal intelligence questionnaires resulted in the categories classified in Table 3. The results of this questionnaire indicate that students have different levels of intelligence. With this, lecturers have data about the intelligence possessed by students so that they can be given the right treatment.

Table 3. Intrapersonal and Interpersonal Intelligence Questionnaire Results

Level type	Number of Students
Intrapersonal and interpersonal intelligence are both high	8
High intrapersonal but low interpersonal intelligence	6
High intrapersonal but low interpersonal intelligence	2
Intrapersonal and interpersonal intelligence are both low	11

3. RESULTS AND DISCUSSION

The data in this study came from observations, questionnaires, tests, and interviews. Observations were made since the beginning of the study as a background for formulating research problems. Meanwhile, the selection of research subjects came from the results of a questionnaire with certain considerations. Through the intelligence questionnaire data, the researcher selected four respondents as research subjects classified into 4 types, namely one student with high intrapersonal and interpersonal intelligence, one student with high intrapersonal and low interpersonal intelligence, one student with low intrapersonal and high interpersonal intelligence, and one student with both low intrapersonal and interpersonal intelligence as shown in Table 4.

Table 4. Research Subjects Based on the Criteria of Intrapersonal and Interpersonal Intelligence

Initials	Intrapersonal Score Conversion (on the Scale)	Interpersonal Score Conversion (in Scale)	Criteria
AA	91	88	High-high
BEA	84	75	High-low
BA	77	82	Low-high
AH	67	55	Low-low

Furthermore, for further analysis of mathematical communication skills, it is based on the results of tests and interviews conducted on research subjects from questionnaires. The description of the analysis of students' mathematical communication skills in terms of intrapersonal and interpersonal intelligence with these 4 types of categories in solving mathematical problems, especially in limit and continuous material is presented in detail as follows.

3.1 The Results of the Analysis of the Mathematical Communication Skills for AA

AA is a research subject with a high level of intrapersonal and interpersonal intelligence. An overview of the results of the communication skills test for the written test of AA subjects is presented in Figure 2.
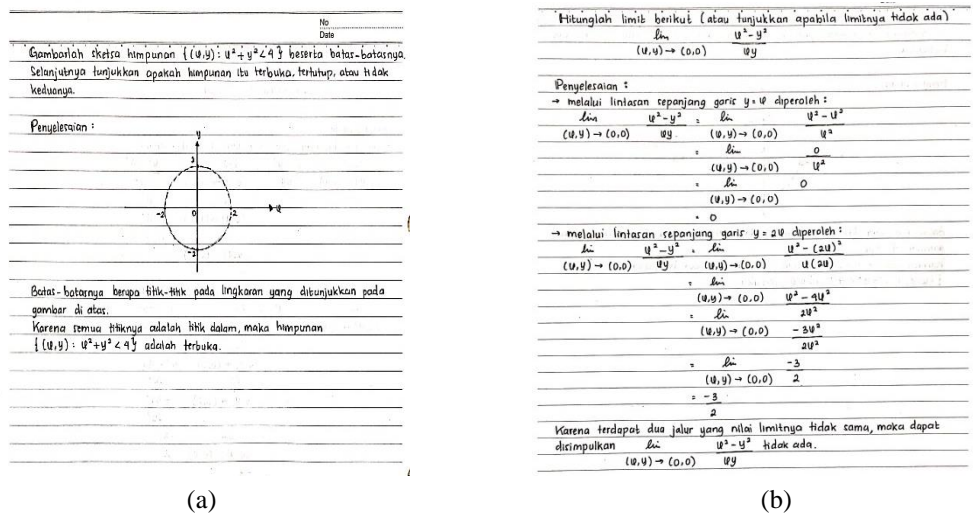

(a) (b)

Figure 2. Answers of AA Subjects for Written Tests for Questions (a) Number 1 and (b) Number 2

The results of the answers of AA subjects were analyzed based on indicators of mathematical communication skills in terms of three aspects of the assessment, namely accuracy, completeness, and fluency. The description of the results of the written test and interview test of AA subjects is presented in Table 5 as follows.

Table 5. Analysis of the Results of the Written Test and Interview for AA

No	Indicator	Written Test Results	Interview Test Results
1	Write down what is known and asked from the question.	AA only rewrote the question and did not specify what was known and asked about.	AA can explain the meaning of questions number 1 and 2 smoothly and without hiccups.
2	Write the answer according to the purpose of the question.	AA writes down each step of answer numbers 1 and 2 systematically and chooses an effective strategy until the correct answer is obtained.	AA can explain what strategy is the most effective for the problem and apply the strategy and write down the complete answer.

(b)

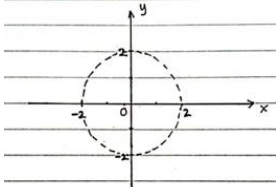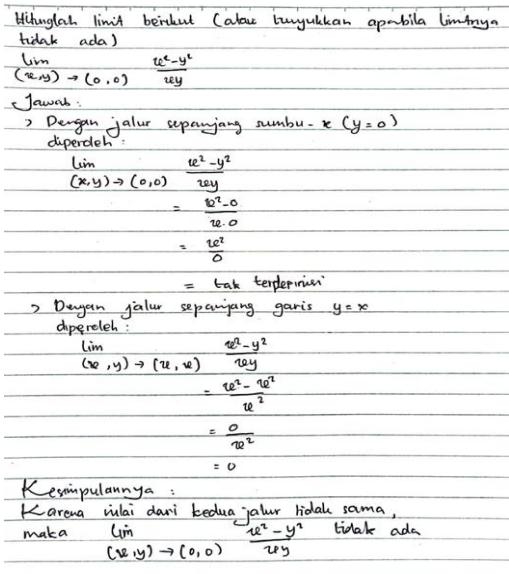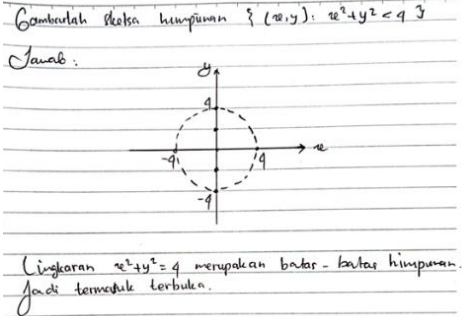|			
		• Strategy number 1 is to choose a path along the $y = x$ and $y = 2x$. • Strategy number 2 is to draw a Cartesian diagram and the appropriate boundaries	
3	Able to give reasons for written answers.	AA can write down the reasons/descriptions and a brief explanation of the written answers so that the correct calculation is obtained.	AA can convey brief reasons about the concepts, formulas, theories used to expedite the procedure for solving the problem, but when asked about the sound definitions, theorems, or concepts used, it takes a long time to recall.
4	Draw a graph that matches the purpose of the question (for question no. 2)	AA can sketch the boundaries of the set shown with graphic components and a complete and correct explanation. 	AA can explain the steps to draw a sketch and give reasons why the set $\{(x, y): x^2 + y^2 < 4\}$ including open sets.
5	Write down mathematical terms, notations, and symbols.	AA can write mathematical terms, notations, and symbols correctly.	AA can show the mathematical terms, notations, and symbols used in the problem.
6	Give a conclusion of the final result of the answer.	AA can write the conclusion of the final answer obtained correctly.	AA can explain the conclusion of the final answer obtained clearly.
7	Review the written answer.	AA did not write down the results of rechecking the answers but in the calculations, there were no errors.	AA is confident in explaining that the answers that have been written are correct and have checked the calculations in the questions.

Table 5 shows that AA subjects with both high levels of intrapersonal and interpersonal intelligence have the following characteristics: (1) AA has good written communication skills, including writing answers accurately, procedures and steps are complete, smooth, and there are no calculation errors and (2) AA has excellent oral communication skills, including being able to explain the meaning of questions starting from what is known and asked, explanations of each written completion step, and conveying conclusions from the final results obtained accurately, completely, and fluency. These verbal communication skills are closely related to the interpersonal intelligence possessed by students, namely the ability to interact face-to-face [29]. Therefore, it is easier for AA to provide explanations for the questions asked and there are no obstacles.

3.2 The Results of the Analysis of Mathematical Communication Skills for BEA

BEA is a research subject with a high level of intrapersonal and low interpersonal intelligence. Description of the results of the analysis of written and oral communication skills obtained through written tests and interviews as shown in Table 6 as follows.

Table 6. Analysis of the Results of the Written Test and Interview for BEA

No	Indicator	Written Test Results	Interview Test Results
1	Write down what is known and asked from the question.	BEA only rewrites question number 1 on the answer sheet without specifying what is known and asked about, while number 2 only writes down what is asked about but is incomplete.	BEA only points to the questions given and tells what the questions are asking.
2	Write the answer according to the purpose of the question.	BEA wrote down each step of answer number 1 and 2 systematically and chose a problem-solving strategy, but there were some errors in the writing. • Strategy number 1 is to choose the x-axtrajectoryond along the $y = x$ line. The selection of the x-axis path is still less effective because the results are not defined. • Strategy number 2 is to draw a Cartesian diagram and the appropriate boundaries but there is an error in calculating the radius of the circle.	It is difficult for BEA to explain what strategy is the most effective for the problem because BEA only looks at examples that have been discussed in class and applies a similar strategy to the problem.
3	Able to give reasons for written answers.	BEA was able to write down the reasons/descriptions and a brief explanation of answer number 1, but only a few explanations were written for question number 2. 	BEA only explains the answers that have been written without giving reasons why the set $\{(x,y): x^2 + y^2 < 4\}$ Is open.
4	Draw a graph that matches the purpose of the question (for question no. 2)	BEA can draw a boundary sketch of the set $\{(x,y): x^2 + y^2 < 4\}$ However, the graphic components were incomplete, miscalculations were made, and the explanations were short enough that the final answer was wrong. 	BEA had a hard time where to start when asked to draw a graph of $x^2 + y^2 < 4$ because it was confused by the "less than" sign (<).
5	Write down mathematical	BEA made a few mistakes in writing limit notation.	BEA only explained the use of limit notation in the question, but there were a

	terms, notations, and symbols.	$$\lim_{(x,y)\to(0,0)} \frac{x^2-y^2}{xy}$$ $$= \frac{x^2-0}{x\cdot 0}$$ $$= \frac{x^2}{0}$$ $$= tak\ terdefinisi$$ (limit notation is not written completely). the correct one is, $$\lim_{(x,y)\to(0,0)} \frac{x^2-y^2}{xy} = \lim_{(x,y)\to(0,0)} \frac{x^2-0^2}{x\cdot 0}$$ $$= \lim_{(x,y)\to(0,0)} \frac{x^2}{0}$$	few mistakes in writing it on the answer sheet.
6	Give a conclusion of the final result of the answer.	BEA can write the conclusion of the final answer obtained quite briefly.	BEA can provide a clear conclusion of the final answer obtained.
7	Review the written answer.	BEA only checks the mathematical calculations in each step of the answers that have been written.	BEA feels doubtful and dissatisfied with the answers that have been written.

Table 6 shows that BEA subjects with high levels of intrapersonal and low interpersonal intelligence have the following characteristics: (1) BEA has fairly good written communication skills, including writing complete and fluent answers, but there are some calculation errors and other minor components that cause the answers to be wrong and (2) BEA has poor oral communication skills, including substandard and a little halting in explaining the chosen problem-solving strategy, the settlement steps applied and the conclusions from the final results obtained.

These results indicate that students with high intrapersonal intelligence, but who have interpersonal intelligence tend to do better on the written test than on the oral test. This must be overcome by developing oral communication skills by practicing repeatedly to express what is expected smoothly without text [30]. This is by previous research that in addition to having good knowledge, students must also have the ability to communicate the knowledge or information obtained to be effective [31].

3.3 The Results of the Analysis of Mathematical Communication Skills for BA

BA is a research subject with a low level of intrapersonal and high interpersonal intelligence. Description of the results of the analysis of written and oral communication skills obtained through written tests and interviews as shown in Table 7 as follows.

Table 7. Analysis of the Results of the Written Test and Interview for BA

No	Indicator	Written Test Results	Interview Test Results
1	Write down what is known and asked from the question.	BA only writes down questions for number 1, while number 2 immediately draws the requested graph.	BA can state what is known and ask questions correctly and precisely.
2	Write the answer according to the purpose of the question.	BA does not write down the selected strategy in full. BA made an error in choosing the origin $(0,0)$ to be substituted so that the result was indeterminate, namely $\frac{0}{0}$. Meanwhile, one of the selected paths is the path along the x-axis ($y = 0$) so that the answer is undefined.	BA can explain the problem-solving strategies used and apply these strategies even though there are errors in path selection.
3	Able to give reasons for written answers.	BA did not write down the reasons/descriptions and brief explanations	BA can provide brief reasons about the concepts, formulas, and theories used

		until it was concluded that $\lim_{(x,y)\to(0,0)} \frac{x^2-y^2}{xy}$ did not exist.	to expedite the problem's procedure.
4	Draw a graph that matches the purpose of the question (for question no. 2)	BA sketches the boundaries of the set $\{(x,y): x^2 + y^2 < 4\}$ by making a closed curve in the form of a circle and shading the area without any further explanation of the boundaries and his statement that the set is closed.	BA can explain the meaning of the sketch that has been described even though there are some errors.
5	Write down mathematical terms, notations, and symbols.	BA made a few mistakes in writing limit notation. It should be written like this: $$\lim_{(x,y)\to(x,0)} \frac{x^2-y^2}{xy} = \lim_{(x,y)\to(x,0)} \frac{x^2-0^2}{x\cdot 0}$$ $$= \lim_{(x,y)\to(x,0)} \frac{x^2}{0}$$	BA can clearly explain mathematical notation or symbols used.
6	Give a conclusion of the final result of the answer.	BA does not write the conclusion of the final answer.	BA can explain the conclusion of the final answer clearly.
7	Review the written answer.	BA does not re-check/recheck answers that have been written correctly.	BA feels less confident in explaining the answers that have been written because they don't check the mathematical calculations

Table 7 shows that BA subjects with low levels of intrapersonal and high interpersonal intelligence have the following characteristics: (1) BA has poor written communication skills, including writing complete answers but there is an error in choosing a problem-solving strategy that causes the answer to be wrong. The same thing was found in another study where students with low abilities were able to use concepts/formulas and were aware of the conceptual errors made but did not know how to correct them. Students with this type make more misunderstandings and confusion in choosing a solution strategy and (2) BA has quite good oral communication skills, including being fluent in explaining answers written according to his thoughts, some of which are stated there are still errors so they still need guidance.

3.4 The results of the analysis of mathematical communication skills from AH

AH is a research subject with quite low levels of intrapersonal and interpersonal intelligence. Description of the results of the analysis of written and oral communication skills obtained through written tests and interviews as shown in Table 8 as follows.

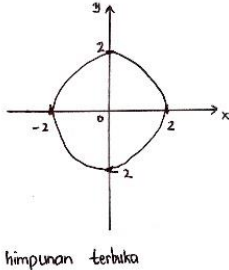**Table 8.** Analysis of the Results of the Written Test and Interview for AH

No	Indicator	Written Test Results	Interview Test Results
1	Write down what is known and asked from the question.	AH did not write down what was known and asked questions but answered them immediately.	AH only reads the questions given when asked what is known and asked.
2	Write the answer according to the purpose of the question.	AH does not have a proper problem-solving strategy. AH only substituted (0, 0) into the question so that the final answer was wrong.	AH cannot explain what strategy is the most effective for the problem and only explains how to substitute (0,0) into the problem.
3	Able to give reasons for written answers.	AH did not write down the reasons/descriptions and a brief explanation of the written answers. $$\lim_{(x,y)\to(0,0)} \frac{x^2-y^2}{xy} \cdot \lim_{(x,y)} \frac{0^2-0^2}{0(0)}$$ $$= 0$$	It is difficult for AH to explain the concepts, formulas, theories that will be used to expedite the procedure for solving the problem.
4	Draw a graph that matches the purpose of the question (for question no. 2)	AH sketches the boundaries of the indicated set completely, but there is a slight error. AH draws a closed curve in the form of a circle even though it doesn't use a compass, but says that the set $\{(x,y): x^2 + y^2 < 4\}$ is open. himpunan terbuka	AH is difficult to explain the meaning of the sketch that has been drawn but says that the set drawn is open.
5	Write down mathematical terms, notations, and symbols.	AH can write limit notation correctly.	AH was able to explain the limit notation used even though an error occurred in the early steps of choosing a problem-solving strategy.
6	Give a conclusion of the final result of the answer.	AH did not write down the conclusion of the final answer completely.	AH could not explain the conclusion of the final answer obtained.
7	Review the written answer.	AH did not re-check/double-check the answers that have been written.	AH is not sure about explaining the answer that has been written.

Table 8 shows that AH subjects with both quite low levels of intrapersonal and interpersonal intelligence have the following characteristics: (1) AH has poor written communication skills, including AH does not understand the meaning of the question so that the written answer does not match the purpose of the question and the overall answer written is wrong. There are previous studies show that students with low intrapersonal and interpersonal intelligence have low thinking skills and this has an impact on their written ability to describe information [32] and (2) AH has poor oral communication skills, including difficulty in explaining written answers because they do not understand the meaning of the question and do not know which formula or strategy is right for the question. Similar to other studies, data shows that students with low intrapersonal and interpersonal skills have difficulty communicating their information to others [33]. Thus it can be concluded that subjects with low intrapersonal and interpersonal intelligence

resulted in low written and oral mathematical communication skills as well. Based on previous research, the low level of mathematical communication skills indicates the inability of students to write and convey mathematical ideas systematically [34].

Based on the description of the results of the analysis on four research subjects with different types of cases, it can be concluded that the diversity of levels of intrapersonal and interpersonal intelligence possessed by students produces different mathematical communication skills. The higher the level of intrapersonal and interpersonal intelligence possessed, the better the mathematical communication skills possessed, and vice versa. Even other research mentions that intrapersonal and interpersonal intelligence affect students' mathematics learning achievement [35]. Students will be more successful if they know which intelligence is more dominant in themselves. Meanwhile, less dominant intelligence can be developed with supportive activities [36]. Therefore, the creation of a learning atmosphere and enrichment of activities is needed for the development of intelligence possessed and can improve students' mathematical communication skills.

Based on the analysis that has been carried out in this study, this study has several weaknesses such as the analysis of mathematical communication skills is only limited to research subjects in higher education and certain materials, the level of analysis is less in-depth because it only uses tests and interviews, and analysis based on two variables. which are different, namely intrapersonal and interpersonal intelligence. Therefore, for other researchers who conduct similar research, it is recommended that an analysis of mathematical communication skills be carried out for limit and continuity material or other materials that are more in-depth and associated with other more relevant variables. This research can also be used as inspiration and additional information to conduct further assessment and analysis to obtain better similar research by taking into account the existing weaknesses.

4. CONCLUSION

The results of this study indicate that there are differences in the mathematical communication skills of research subjects in solving math problems in terms of their intrapersonal and interpersonal intelligence levels. These differences include 1) students with both high levels of intrapersonal and interpersonal intelligence have excellent written and verbal communication skills, 2) students with high levels of intrapersonal intelligence but low interpersonal skills tend to be good in written communication but are not fluent in expressing ideas or opinions. verbally, 3) students with low levels of intrapersonal and high interpersonal intelligence tend to be less good in choosing problem-solving strategies and writing answers even though there are some errors but are better in expressing their opinions orally, and 4) students with intrapersonal and interpersonal intelligence levels both of which are quite low tend to be weak in terms of communication both written and verbal.

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