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Malaysian SILN Students' Difficulties in Statistical Understanding and Mathematical Communication

Juliana Kristin Harjati[1*], Budi Usodo[2], Farida Nurhasanah[3]

[1] Postgraduate Programme of Mathematics Education, Universitas Sebelas Maret, Indonesia
[2,3] Faculty of Teacher Training and Education, Universitas Sebelas Maret, Indonesia

*Corresponding author: julianakristinharjatipppk@gmail.com

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ABSTRACT

Purpose -Indonesian children abroad, including those in Malaysia, are entitled to quality education through *Sekolah Indonesia Luar Negeri* (SILN). However, the existence of schools alone is insufficient. This study explores students' difficulties in learning statistics, focusing on mathematical communication within a multilingual learning environment.

Methodology - Using a qualitative descriptive design, the study involved two mathematics teachers and 32 students selected via purposive sampling from an Indonesian school in Malaysia. Data were collected through in-depth interviews (Zoom) and mathematical communication tests (WhatsApp)—analysis employed cross-comparison techniques, aligning teacher responses with student test results based on predefined communication indicators.

Findings - Three main difficulties emerged: (1) student errors in multi-digit statistical computation and representation, (2) instructional challenges due to teachers' limited background in mathematics education, and (3) language barriers stemming from the use of Malay in daily life and Indonesian in instruction, impacting comprehension and expression in mathematical contexts.

Novelty - This study uniquely connects statistical learning challenges with cross-linguistic dynamics and mathematical communication in an overseas Indonesian school context.

Significance - Findings provide insights for educators, curriculum developers, and policymakers to enhance statistical instruction and communication skills in multilingual settings, contributing to improved educational quality for Indonesian students abroad.

Keywords: Indonesian education in Malaysia; Mathematical communication; Statistics; Student difficulties.

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1. Introduction

The Indonesian government is constantly striving for the equitable distribution of Indonesian education. The main goal is to realize that Indonesia aims to educate the nation. SILN stands for Sekolah Indonesia Luar Negeri. SILN is a school established by the Indonesian government to provide educational facilities for Indonesian children living abroad. BNP2TKI (Indonesian Migrant Worker Protection Agency) reports the publication of data on the placement of Indonesian migrant workers from year to year. In 2020, there were 113,436 placements of Indonesian migrants; in 2021, it decreased to 72,624 placements; in 2022, it increased again to 200,761 placements; in 2023, there were 274,965 placements; and in 2024, there were 297,434 placements, dominated by women (BP2MI, 2025). The data shows that Indonesian citizens are not only within the country, but are spread across various countries yearly. Article 31, paragraph 1 of the 1945 Constitution states that every citizen has the right to education. This means that the government's efforts to fulfill the right to education are carried out in areas close to the center of government, in 3T areas (underdeveloped, frontier, and outermost), and for Indonesian citizens living abroad.

From 1956 to 2025, 221 Indonesian schools abroad were spread across various countries. The Indonesian schools abroad are spread in Malaysia, Saudi Arabia, Egypt, Myanmar, Singapore, Japan, Thailand, Taiwan, Philippines, China, Brunei Darussalam, and the Netherlands (Direktorat Jenderal Pendidikan Anak Usia Dini, Pendidikan Dasar, dan Pendidikan Menengah, 2025). The existence of Indonesian schools abroad indicates the Indonesian government's attention to equalizing education for every citizen abroad. Malaysia is one of the destination countries for Indonesian migrant workers. In Malaysia, there are three Indonesian schools, namely Sekolah Indonesia Kuala Lumpur (SIKL), Sekolah Indonesia Johor Bahru (SIJB), and Sekolah Indonesia Kota Kinabalu (SIKK). Sekolah Indonesia Kota Kinabalu in Malaysia provides several educational services. The services are formal education (elementary, junior high, high school, and vocational school), non-formal education (pre-school and PKBM), Community Learning Center (CLC), and Distance Open High School (TJJ) (Sekolah Indonesia Kota Kinabalu, n.d.). CLC education services were initiated to fulfill the educational rights of Indonesian Migrant Worker children, whom SIKK did not reach as the parent school due to long distances and limited capacity of SIKK. Based on the official website of Sekolah Indonesia Kota Kinabalu accessed in 2025, there were 111 main CLCs at the elementary level and 45 main CLCs at the junior high school level. The 156 main CLCs have branches known as Learning Activity Centers or TKBs. The total number is 211 TKBs for elementary school CLCs and 198 TKBs for junior high school CLCs. The total number of students was 18,787, consisting of 13,782 elementary school students and 5,005 junior high school students (Sekolah Indonesia Kota Kinabalu, 2022).

Educating the nation is not only about equalizing education abroad, but also about the quality of learning. The quality of mathematics learning needs to be continuously improved. Mathematics is a tool of thought, and mathematics is the driving force for the birth of various sciences supporting human life, including solving life problems (Sadewo, Purnasari, & Muslim, 2022). For example, statistics is often applied in everyday life. So, understanding the concept of mathematics is needed to obtain the information. One example of the application of Statistics for Indonesian migrant workers in Malaysia is to collect data on monthly expenses and income from plantations in Kundasang. The other example is to read trends in currency exchange rates between the Ringgit and the Rupiah, and determine the average exchange rate fluctuations to determine the best time to send money to their families back home. Statistics can also be used to analyze data related to investments in stocks, cryptocurrency, and property, calculate the price mode of goods if working as a business person in the market, and so on.

However, the results of research conducted by Kraeng, Y.F. in 2021 show that some students still have difficulty solving math problems on Statistics material. The students face some difficulties. One of the difficulties is understanding the meaning of the sentences used to state the problem and converting story problems into mathematical sentences. The other difficulties are determining the relationship between known and questioned elements, implementing known and questioned elements into formulas, and making conclusions.

The 21st-century education demands human resources who not only have conceptual knowledge but can also master various skills, including communication skills. When communicating, there is an interaction of ideas that requires synchronization of thoughts between one person and another (Pramuditya, Wahyudin, & Nurlaelah, 2021). The sender and receiver of the message try to synchronize their thoughts so that they have a common understanding and there is no misperception of a message. These activities often occur during math learning. Teachers, students, and teaching materials are the parties involved in communication. Thus, communication skills are important in mathematics (Amral, 2020). Consequently, students should have mathematics communication ability as an essential component of mathematics (Musdi, Syaputra, Arnellis, & Harisman, 2024; Indriani & Angraini, 2025).

The National Council of Teachers of Mathematics (NCTM has formulated the mathematics learning objectives. The objectives are learning to communicate (mathematical communication), learning to connect ideas (mathematical connection), learning to reason (mathematical reasoning), learning to solve a problem (mathematical problem solving), and the formation of positive attitudes in mathematics (Santosa & Ginting, 2016). The Ministry of National Education Number 24 of 2004 states that mathematical communication is the ability or capability of students to express and interpret mathematical ideas orally, in writing, or demonstrate what is in a mathematical problem. This definition aligns with Sembiring's statement that mathematical communication allows students to express and interpret mathematical ideas orally, by speaking or discussing, or in writing. The ideas are conveyed through pictures, tables, diagrams, formulas, and demonstrations (Sembiring, Simorangkir, & Anzelina, 2021). Some indications that show a student has mathematical communication skills include the ability to: (1) model situations using pictures, graphs, and algebraic expressions, (2) express and explain thoughts about mathematical ideas and situations, (3) explain mathematical ideas and definitions, (4) read, listen, interpret, and evaluate mathematical ideas, (5) discuss mathematical ideas and make conjectures and convincing reasons, and (6) appreciate the value, notation of mathematics, and its role in everyday problems and the development of mathematics and other disciplines (National Council of Teachers of Mathematics, 2000).

Statistics as a branch of mathematics focuses on data collection, presentation, analysis, and interpretation. Understanding the concept requires the ability to communicate, not just using numbers to count. Mathematical communication in learning Statistics can be seen from students' ability to present data in various forms of representation, such as tables, diagrams, and graphs. This ability can also be seen from interpreting the results of calculating the size of the center, the size of the location, and the size of the spread using the correct mathematical language.

The definition of mathematical communication in this study is based on Depdiknas, Sembiring, and NCTM, namely the ability of students to express mathematical ideas in the form of pictures, tables, diagrams, formulas, and problem-solving strategies using symbols and mathematical language in writing to others. Mathematical language is a formal language used to describe patterns, relationships, and structures with precision and consists of symbols,

syntax rules, and semantics that allow accurate communication of ideas, have strict rules in writing, can be understood by anyone even though it is not the mother tongue, and is not ambiguous because it uses symbols and notations that have a fixed meaning (Devlin, 2000). Based on this understanding, the indicators of mathematical communication skills on Statistics material in this study are the ability to (1) communicate ideas using mathematical language or symbols appropriately, (2) model or re-express situations into various forms of mathematical representations such as images, tables, diagrams, or graphs, and (3) present well-organized and structured problem solving.

Liliweri (2011) states that communication becomes effective if both parties have the same meaning for the messages exchanged. It means that the use of the same language increases the effectiveness of communication. Ki Hadjar Dewantara emphasized that teaching must be based on nationality. This means that the language used in Indonesian schools must be Indonesian (Latif, 2020). The two statements are not contradictory if students and teachers are in Indonesia. Indonesian school students in Malaysia have grown and developed in a Malay-speaking environment. This is thought to contribute to learning difficulties, especially in Mathematics. Students have limitations in mastering the Indonesian language.

This research aims to analyze students' difficulties in learning mathematics in understanding Statistics, focusing mainly on their mathematical communication skills. Despite increased access to mathematics education through SIKK and CLCs, limited empirical studies have investigated the role of mathematical communication in shaping students' understanding of statistics, especially within multilingual learning environments. This research is expected to provide an initial overview of the factors influencing students' understanding of mathematics, especially statistics. It also provides a basis for developing more effective learning strategies for Indonesian Schools in Malaysia. It is important to understand students' learning difficulties from an early stage. So, mathematics learning implemented in Indonesian schools abroad, especially Malaysia, can be adjusted to the teaching and learning needs of students and teachers there.

2. Methods

2.1. Research Design

This study employs a qualitative research design with a descriptive qualitative approach. Sugiyono (2015) states that qualitative methods are used to obtain in-depth data. Data that contains meaning. Meaning refers to the actual and specific data reflecting the value behind what is visible. Therefore, qualitative research does not aim for generalization but emphasizes exploring meaning.

In line with this perspective, the qualitative approach in this study was chosen. It aims to deeply explore the underlying reasons behind the difficulties faced by students of Indonesian Schools Abroad. These difficulties are related explicitly to learning Mathematics, particularly in Statistics. Qualitative methods enable the researcher to investigate the perspectives constructed by students and teachers through their interactions during the learning process.

Through this lens, the researcher can gain a more comprehensive understanding of students' mathematical communication barriers. These challenges are often not identifiable through quantitative data such as test scores or numerical outcomes. This approach is particularly relevant for examining the influence of contextual and cultural factors in learning. One significant example is the role of language in classroom interactions and instructional materials. Qualitative inquiry allows the researcher to analyze how the learning environment shapes students' understanding of statistical concepts by focusing on these aspects.

2.2. Partisipants and Sampling

The population in this study is Indonesian schools in Malaysia. The subjects of this study were teachers and students of Indonesian schools in Malaysia—determination of research subjects using a purposive sampling technique. The purposive sampling technique is done by determining the characteristics of the population, then the researcher tries to find individuals who have these characteristics (Johnson & Christensen, 2008). Purposive sampling is a technique with specific considerations (Sugiyono, 2016). Sample selection is based on research objectives (Moleong, 2018). Based on Johnson, Sugiyono, and Lexy, the purposive sampling technique in this study is that the sample is selected based on specific considerations or criteria related to the research objectives. Then the researcher tries to find individuals who have these criteria. The criteria for selecting the interviewed teacher are that the subject is a professional teacher with a bachelor's degree in mathematics education who directly deals with mathematics learning in Indonesian schools in Malaysia. The selection of subjects subjected to the mathematical communication ability test in this study is that the subject is an Indonesian school student in Malaysia with a secondary school education level and has studied statistics material at school.

2.3. Data Collection Techniques

The data collection technique used in this research is Triangulation. Triangulation is a data collection technique that combines various data collection techniques and data sources that already exist (Hasibuan, 2024). Triangulation can also be termed cross-check, which means using data from different perspectives. Triangulation can be done by collecting data from different sources: teachers, students, and teaching materials. This triangulation is called source triangulation.

Researchers conducted unstructured interviews (in-depth interviews) to obtain information related to difficulties in learning mathematics. The interviews were conducted with two mathematics teachers, one at the Community Learning Center (CLC) as one of the education service centers, and the other who teaches mathematics at Sekolah Indonesia Kota Kinabalu as a primary school. The researcher collaborated with a math teacher at one of the CLCs to create a WhatsApp group to collect data on mathematical communication skills. The students who became the research subjects joined the WhatsApp group through the link sent by the math teacher. The data collection method researchers use is unstructured interviews (in-depth interviews) conducted with mathematics teachers via Zoom and using mathematical communication skills tests sent via WhatsApp.

2.4. Data Analysis Procedures

The interview transcripts were cross-compared with the test results that the students had carried out and then analyzed based on indicators of mathematical communication skills according to the Ministry of National Education, Sembiring, and NCTM, written in the form of descriptions. The indicators of mathematical communication skills according to the Ministry of National Education, Sembiring, and NCTM in this research are that students can (1) communicate ideas using language or mathematical symbols appropriately, (2) model or re-express situations into various forms of mathematical representation such as drawings, tables, diagrams, or graphs, and (3) present well-organized and structured problem solving.

3. Results and Discussion

3.1. Results

Researchers conducted in-depth interviews with two professional teachers who are undergraduates in mathematics education and who taught at Indonesian schools abroad in

Malaysia. Researchers explored the difficulties in mathematics learning to find students' difficulties in understanding statistics. Researchers chose one teacher as a sample from the primary school, namely the Kota Kinabalu Indonesian School (SIKK), and another teacher as a sample from the Community Learning Center (CLC). Interviews were conducted via Zoom for efficiency due to long distances and conditions that did not allow face-to-face (live) meetings. Researchers were in Surakarta (Indonesia), CLC Teachers were in Lahad Datu (Malaysia), and SIKK Teachers were in Kota Kinabalu (Malaysia).

Based on the recorded results of interviews with the two teachers, several difficulties were found in learning mathematics at Indonesian schools in Malaysia. The difficulties were that students had not memorized multiplication from one to ten, they were not used to integer operations, they had weak mathematical literacy, and the material's content in books was considered too heavy. The following interview results show the difficulty of memorizing multiplications from one to ten and that the interviewees are unfamiliar with integer operations. Teacher G2 observed two key difficulties during his two years at SIKK. Many students struggled to memorize multiplication tables up to ten. Most students were unfamiliar with basic integer operations such as addition, subtraction, multiplication, and division. These foundational gaps disrupted learning at the high school level. They also made it more complicated for students to grasp advanced mathematical concepts.

Meanwhile, literacy-related difficulties were highlighted through the following interview with Teacher G1. He explained that while students were generally able to solve numerical problems, they struggled significantly with mathematical story problems due to language barriers. Using Indonesian textbooks posed challenges because students were more familiar with the Malaysian language and currency. For example, problems involving Rupiah were confusing for students accustomed to Ringgit, and large numbers such as "213,300" were complex for younger students to read. Teacher G1 addressed this by contextualizing problems using familiar local terms and gradually introducing Indonesian terms once the basic concepts were understood. He also emphasized that comprehension problems stemmed from the difference between the language used in the teaching materials and the students' everyday life experiences.

Another difficulty related to the material considered too complicated can be seen in the following interview results. Teacher G2 explained that a significant challenge in teaching mathematics at CLC is that students feel the material is too difficult. Especially the content in the 13th edition of the textbook. He noted that the material in this book is quite difficult for us as *guru bina* (supervising teachers), those officially assigned from Indonesia to teach at Indonesian Overseas Schools (SILN). Even more so for the *guru pamong* (local teaching assistant), local educators assisting with instruction at SILN. The supervising teachers at CLC do not necessarily have a basic knowledge of mathematics. So, simplifying the material is needed for schools abroad, especially those with CLC. That is very necessary.

Mathematics learning is inseparable from arithmetic operations. Application of mathematics to everyday life, and companion books as learning resources. The interview results show that students' mathematics learning difficulties are interrelated. Students do not understand the contents of the books they use as learning resources. It happens due to differences in language and experience. In daily life, students use Malay, but books use Indonesian.

Students experience difficulties when working on math problems related to everyday life because of the language differences. Even though students then began to understand the meaning of the questions, in the end, they experienced difficulties because they could not carry out counting operations. Even when they can understand and calculate the questions, students

still have difficulty communicating, for example, because the Rupiah number, which consists of several digits, makes it difficult to express it (read). This shows that problems in learning mathematics relate to students' mathematical communication skills.

Students must have mathematical communication skills to understand statistical material. Researchers need to conduct tests on students to obtain data to be more accurate regarding students' difficulties in understanding Statistics material regarding their mathematical communication skills. Using the statistics material, researchers conducted a mathematical communication skills test on CLC Kundasang class IX students. Based on the test results, it was found that students' mathematical communication skills were still relatively low. The results of the answers to the subject A5 are shown in Figure 1.

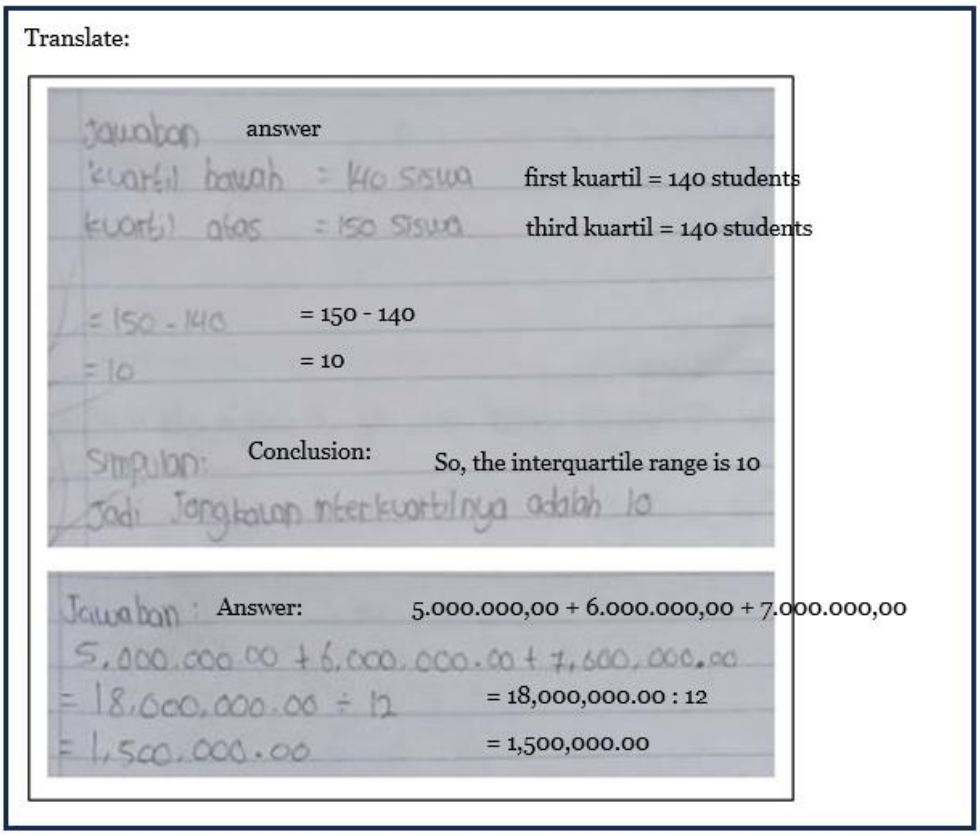


Figure 1. Answers to the Mathematical Communication Ability Test Subject A5

According to Figure 1, subject A5 did not meet the indicators for communicating ideas using language or mathematical symbols. This is evident from errors in writing mathematical expressions in two responses. In the first response, the subject directly wrote "=150 - 140" without explaining the purpose of the calculation, which should have represented the interquartile range. The correct way to write it is:

$$interquartile\ range\ =\ 150 - 140 \ldots (1)$$

In the second response, the subject initially wrote "5,000,000.00 + 6,000,000.00 + 7,000,000.00" and only later divided the sum by 12 in the following step. This writing is confusing because the formatting of the Indonesian Rupiah currency is incorrect, which makes the intention of the calculation unclear. It should be noted that the expression “5.000.000 + 6.000.000 + 7.000.000” on the first line is not the same as “(5.000.000 + 6.000.000 + 7.000.000) : 12”. This distinction is important for students to recognize and understand

because the result of "5.000.000 + 6.000.000 + 7.000.000" is 18.000.000 while the result of "(5,000,000+ 6,000,000 + 7,000,000): 12" is 1.500.000. Both values are different.

Furthermore, the subject incorrectly used a period as a decimal separator in writing the Indonesian Rupiah amounts, for example, writing 5.000.000.00 instead of Rp 5.000.000,00, which shows a conceptual error in the notation of Rupiah currency amounts. This error can be confusing when performing addition or division operations. The correct mathematical notation to represent the process of calculating the average is:

$$\frac{\text{Rp } 5.000.000,00 + \text{Rp } 6.000.000,00 + \text{Rp } 7.000.000,00}{12} = \text{Rp } 1.500.000,00 \ldots (2)$$

The low mathematical communication ability is also shown by the results of the answers of the subject A10, which do not meet the indicators in modeling the situations into various forms of mathematical representation shown in Figure 2.

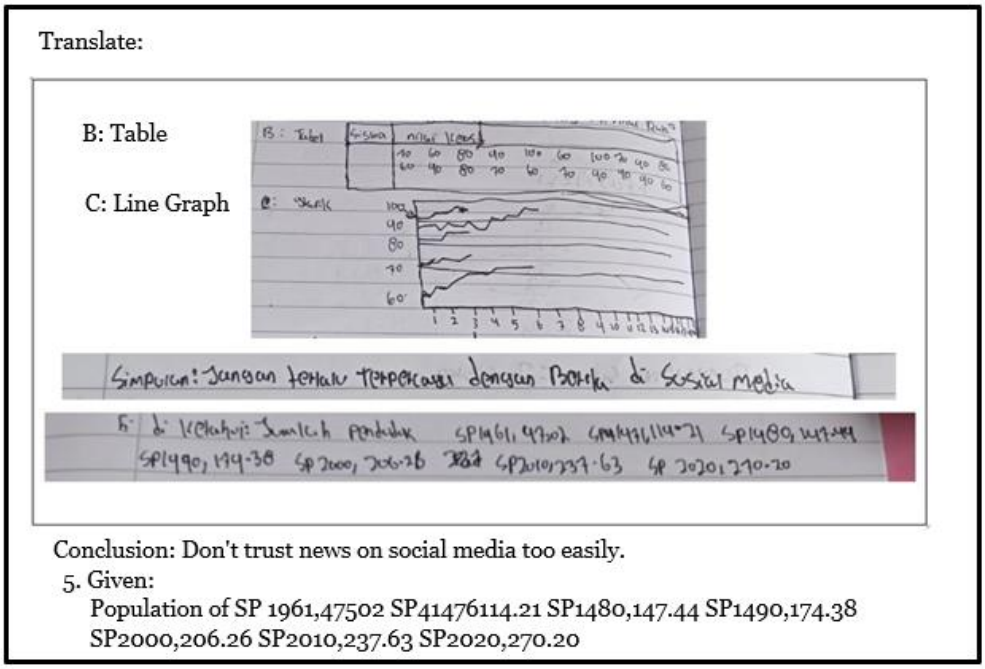


Figure 2. Answer to the Subject A10 Mathematical Communication Ability Test

Figure two shows that subject A10 is not precise in making some form of mathematical representation, for example, making tables, graphs, and writing mathematical sentences. Regarding question number five, subject A10 has not found the best way to communicate known information. Subject A10 writes it sequentially, but without dots and commas as separators. This condition reflects common challenges students face, as Johar and Lubis (2018) reported in their study on students' mathematical representation errors in solving word problems related to graphs. Students often face difficulty in accurately representing information graphically and symbolically. This is due to limited familiarity with the problem context and insufficient guidance during learning.

Mainali (2021) explains that the ability to use and translate various modes of representation is fundamental to effective mathematical communication and problem solving. These modes include verbal descriptions, tables, graphs, and symbolic notation. Many students still have difficulty with this translation process. The reason is that there are limited opportunities to practice connecting and shifting between representations in meaningful contexts. Mainali argues that when students fail to develop these representational transition skills, their understanding remains fragmented, and their problem-solving strategies become limited. Decin (2023) states that the frequency of using visual representations, including

diagrams, computer graphics, and physical models, is correlated with students' beliefs, preferences, and success in solving mathematical problems. Decin's findings demonstrate the importance of visual tools for connecting abstract ideas and student understanding.

Rahmawati (2021), Meilon, Mariani, and Isnarto (2019), as well as Lim et al. (2023), explain that mathematical representation is an important aspect of mathematics learning. It serves as a link between abstract concepts and students' understanding. One way to enhance students' cognitive flexibility and ability to communicate mathematical ideas effectively is to engage with multiple forms of representation, such as verbal, numerical, graphical, and symbolic. However, challenges often arise when students have difficulty translating information across these various modes of representation. These challenges are related to fragmented understanding and limited problem-solving approaches. There is a need for instructional approaches explicitly teaching representational skills and providing multiple opportunities for practice in meaningful contexts. Teachers have an important role in using a variety of representational modes. Especially in teaching, which strengthens students' conceptual understanding and mathematical communication skills. Mastery of mathematical representations supports concept development and empowers students to express ideas clearly, logically, and systematically.

The low mathematical communication ability is also indicated by the answers to the A2 subject, which do not meet the indicators for presenting a well-organized and structured problem solution. The subject cannot write information about what is known about the problem correctly. Consider the following Figure 3.

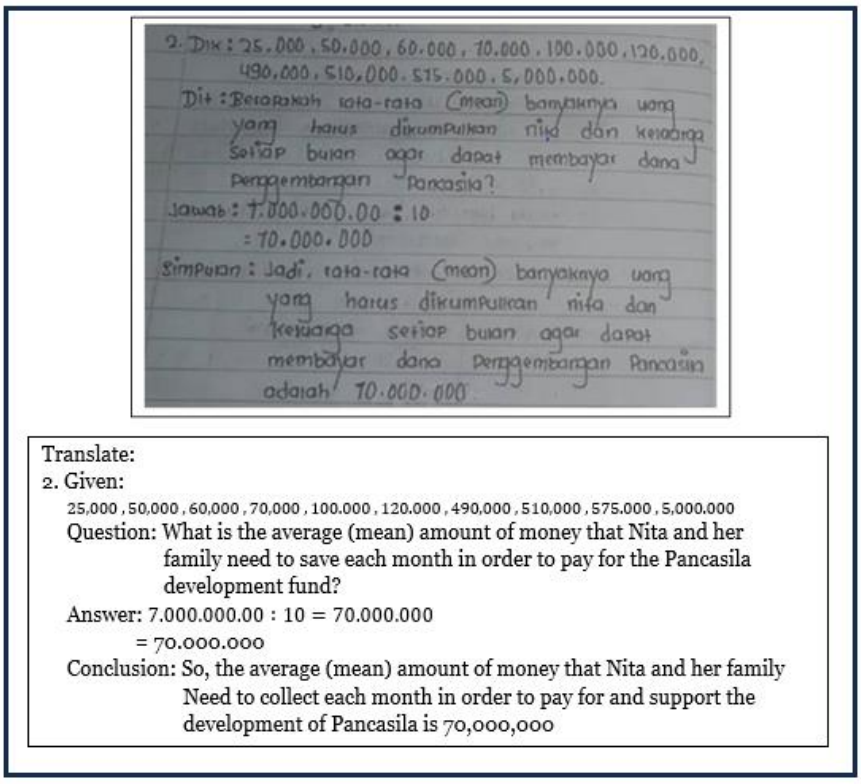


Figure 3. Result of the Initial Mathematical Communication Ability Test of Subject A2

Figure three shows that subject A2 was not precise in correctly writing the rupiah currency. This is seen from writing the known information on the answer sheet in Figure 3. The subject seemed confused about using periods and commas, so he wrote:

25,000 , 50,000 , 60,000 , 70,000 , 100.000 , 120.000 , 490,000 , 510,000 , 575.000 , 5,000.000 (3)

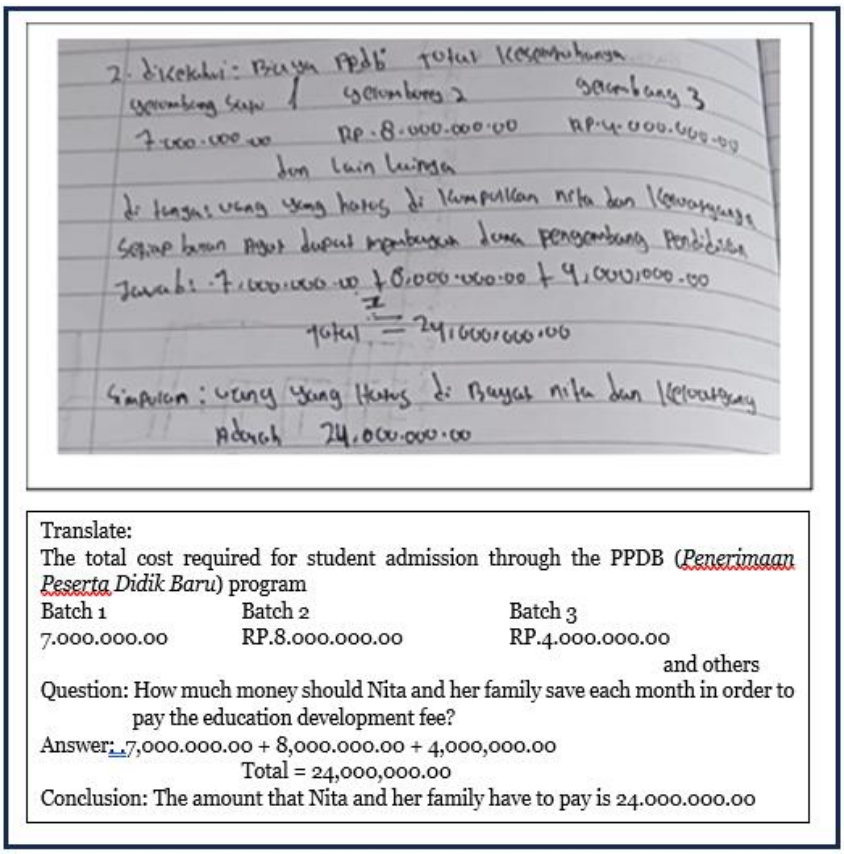
Writing the rupiah currency uses the "comma and zero zero" sign behind the number. An example of the correct writing of the rupiah currency is:

$$Rp\ 25.000{,}00 \quad \ldots \qquad (4)$$

While answering the question, the number 7.000.000.00 suddenly appeared without any explanation from subject A2 regarding its origin. The "point-zero-zero" notation was unclear, as this is not the correct way to write the Indonesian rupiah currency. Furthermore, the information "known" from the calculation steps on the answer sheet did not include the number 7.000.000.00. The subject then proceeded to perform the following division operation:

$$7.000.000.00 : 10 = 70.000.000 \ldots. \qquad (5)$$

The calculation results indicate that subject A2 could not carry out calculations involving the "point-zero-zero" (.00) notation on the Rupiah currency. Subject A10 also experiences this condition.



Translate:
The total cost required for student admission through the PPDB (*Penerimaan Peserta Didik Baru*) program

Batch 1	Batch 2	Batch 3
7.000.000.00	RP.8.000.000.00	RP.4.000.000.00
		and others

Question: How much money should Nita and her family save each month in order to pay the education development fee?
Answer: 7,000.000.00 + 8,000.000.00 + 4,000,000.00
Total = 24,000,000.00
Conclusion: The amount that Nita and her family have to pay is 24.000.000.00

Figure 4. Answer to the Subject A10 Mathematical Communication Ability Test

Figure four shows the subject writing A10 calculating Rupiah money, namely 7.000.000.00+8.000.000.00+4.000.000.00 = 24.000.000.00. This article indicates that subject A10 cannot write mathematical sentences or perform calculations on addition operations involving so many numbers (in this case, millions) correctly. The currency notation used by the subject was inconsistent. For example, in the first data entry, the subject wrote "7,000,000.00" without any currency symbol, while in the second and third entries, the

subject added "RP." before the number. This is incorrect, as the proper format for writing Indonesian currency is "Rp 7.000.000,00," using a period as the thousands separator and a comma for the decimal mark, with a capitalized "Rp" (without a period) and a space after it.

Furthermore, the subject failed to present the information in a proper table format. The data was written without clear column and row separators, making it difficult to interpret. These inconsistencies and formatting errors reflect a lack of familiarity with proper mathematical and monetary notation. In line with the results of interviews conducted with CLC teachers, this condition occurred because students never used that nominal currency in Malaysia, causing them to experience confusion. The subject lives in Malaysia and is accustomed to using the Malaysian ringgit as their everyday currency. This condition causes the subject to have difficulty understanding the value of money and financial transactions discussed in mathematics learning. According to Rahayu, Riantoro, Mansim, and Bauw (2023), socialization of understanding and love for the Rupiah from an early age is very important. This aims to build strong financial literacy in children, including understanding money management.

The Indonesian government has a Bangga Rupiah (Proud Rupiah) program. This program is one of the activities that provide knowledge that the Rupiah is the legal currency in Indonesia. In addition, the Rupiah is also a symbol of the sovereignty of the Republic of Indonesia and a tool for unifying the nation. Therefore, adjusting learning materials to the local context, such as replacing the Rupiah currency with the ringgit, is not recommended. Although this is more contextual in supporting the effectiveness of the mathematics learning process, it is still not recommended. Instead, a learning approach can be used to integrate roleplay of buying and selling using play money in Rupiah. The concept of money management is applied in real terms through games. So that students' understanding becomes more meaningful by continuing to carry out literacy of Cinta Bangga Rupiah (loving and being proud of the Rupiah).

Several research subjects (via WhatsApp) personally sent messages expressing their difficulty in solving the problem. Subjects A8 and A7 felt confused about understanding mathematical language. This lack of understanding causes misconceptions regarding the mean (average value). A conceptual error is shown in Figure 5 below.

Figure 5. Content of WA Message Difficulty of Test by Subjects A8 and A7

Figure five clearly shows that confusion about mathematical language or terms impacts conceptual errors. The conceptual error experienced assumes that the average value (mean) is the largest or smallest value, while other subjects consider it the middle value (median). This impacts the errors of subjects A7 (above) and A8 (below) in working on the problem shown in Figure 6 below.

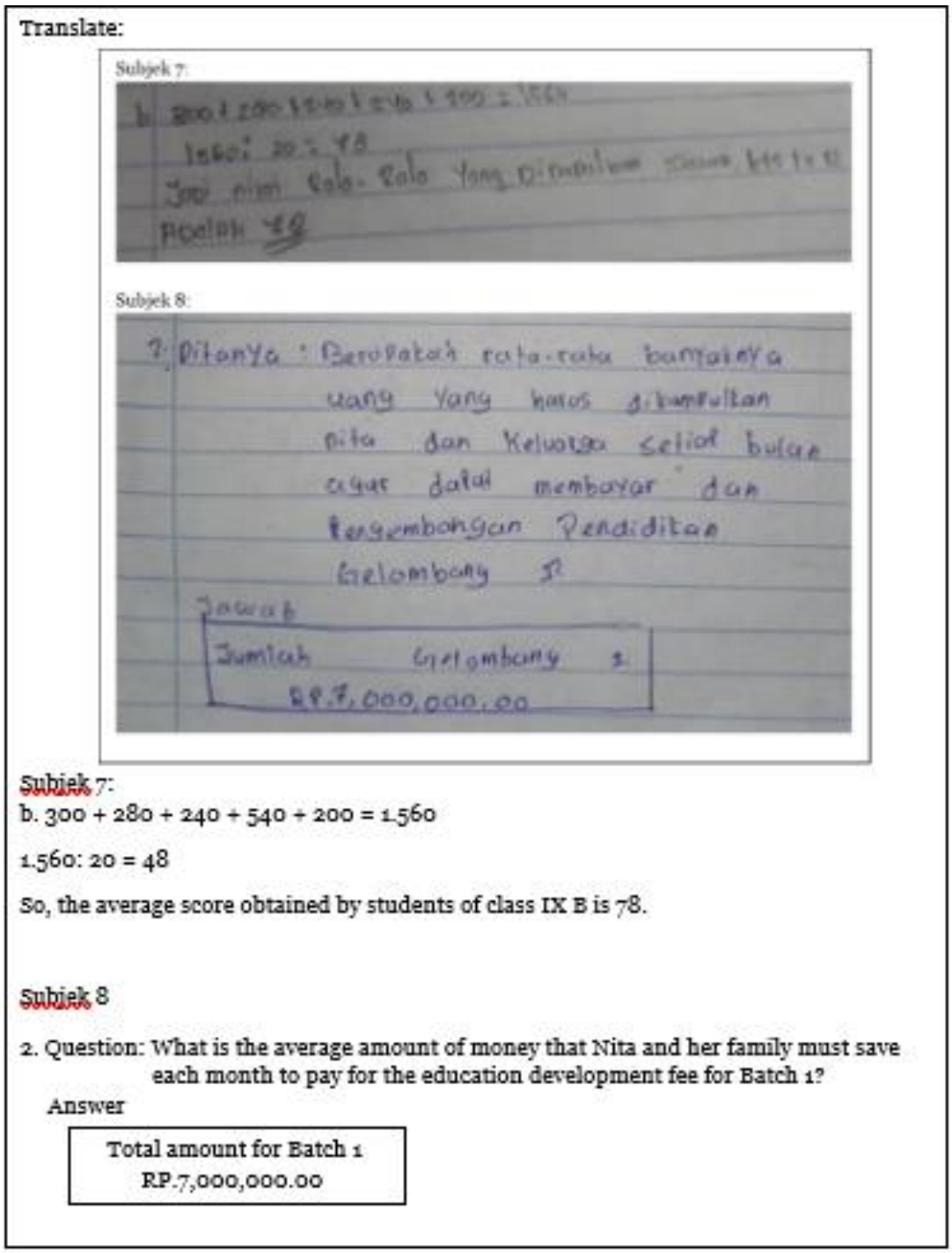


Figure 6. Misconceptions Reflected in the Answers of Subjects A7 and A8

This condition is in line with the research results of Alfarisyi, D., & Sutiarso, S. (2020), which showed that students' low mathematical communication skills were caused by weak conceptual understanding, lack of understanding of mathematical symbols, and students' inability to work on problems. These three factors are interrelated and directly impact students' ability to interpret mathematical information and convey ideas logically and coherently. Subjects who do not understand the symbols or mathematical terms used tend to experience confusion when reading questions. Ultimately, it hinders the thinking process and reduces accuracy in providing answers (Mutodi & Mosimege, 2021). This shows that mastery

of mathematical language and conceptual understanding are important foundations in building effective mathematical communication.

Subject A11 sends a message for guidance. The contents of the message show that subject A11 cannot read a single data contained in the problem, organizes problem solving in a structured manner, and does not understand mathematical representations in the form of diagrams (see Figure 7).

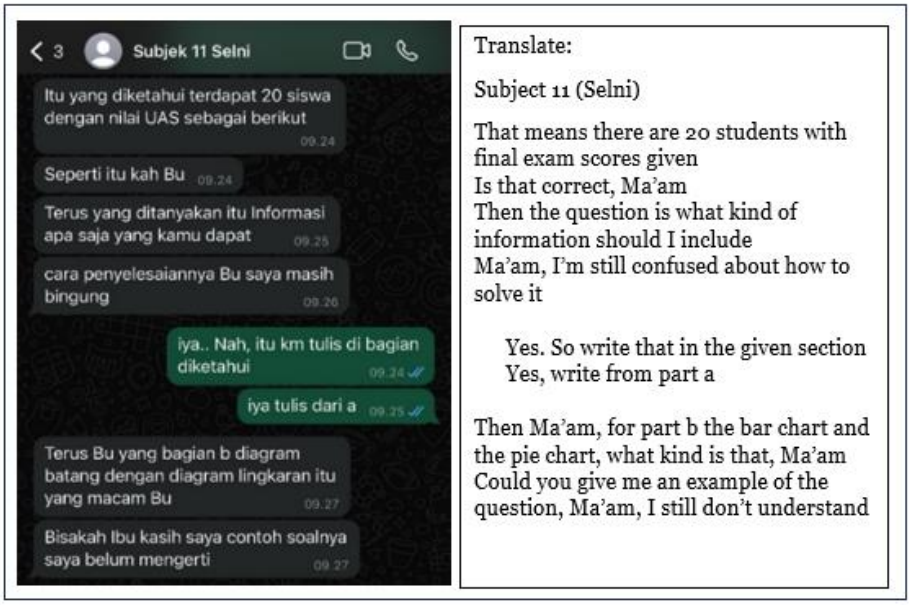


Figure 7. Content of Message WA Difficulty of Test by Subject A11

The student's answer sheet for carrying out the mathematical communication skills test on the statistics material is relevant and strengthens the correctness of the interview data conducted with previous teachers. Researchers still need to conduct interviews with students who are research subjectsobtain more thorough information regarding the difficulties experienced by research subjects during testing. Interviews were conducted via Google Meet, although some subjects could not attend Google Meet due to inadequate internet availability (see Figure 8).

Visual documentation shows a virtual interview session involving 32 Community Learning Center (CLC) Kundasang students. The session explored students' difficulties in solving the mathematical communication test related to statistics. Students' identities are protected, and the screenshot only shows participation.

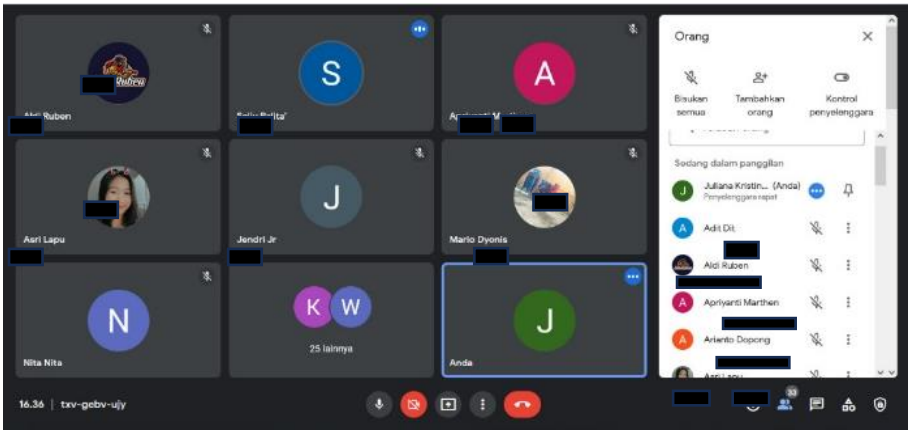


Figure 8. Screenshot Documentation of Student Interviews via Google Meet

Based on interviews with students through Google Meet, several causes of students' difficulties in completing the tests submitted by subjects A2, A4, A7, A8, and A12 were found. Subjects A2, A4, A7, A8, and A12 revealed that difficulties were experienced because the subjects were not careful in working and did not understand the meaning of the words "difference", "average", and "quartile". This results in an inappropriate problem-solving process. The interview script for students via Google Meet with P is the sentence delivered by the researcher as follows:

P: Thank you, children, for joining the Google Meet. Let me introduce Ms. Nana, who used to teach at SIKK and became a mentor teacher at CLC Cinta Mata. She is currently studying at a university in Solo called UNS. So, Ms. Nana needs some information from you regarding difficulties in learning maths. Is that okay?
A; (children respond, may I, may I, may I)
P: Can you tell me how the test went?
A1: Ah, difficult mum
A3: Do not understand, Mum
A11: do not know what to do
A2: I can do some of the numbers, Ms., but some are inaccurate. Should I redo my work?
P: No need.
A2: There is that one, Ms., that I miscalculated.
A5: Ms., I am sorry, I had an answer that was not drawn. I have sent you the answer to question number 5 and question number 6.
P: Yes, Ms. Nana has checked all your answers.
A4: Mum, what are quartiles?
A: (Other children respond to some of the mathematical language in the test questions.)
P: Oh, don't you know what mean, median, mode, quartiles are? Those are terms
A8: I do not know Ms., I have never been taught
P: Never been taught?
A2: Already, already
P: Well, Ms Nana wants to know what kind of experience you had when doing the test. Are there any other difficulties?
A7: There was much reading. Ms., we did not understand.
P: Okay, thank you for the information. Can you understand the reading?
A7: No, Ms.
P: Why?
A7: My head is already dizzy from all the writing. I do not understand what the question means.
P: What books do you use to study at school?
A4: We use student books and LKS, Ms.

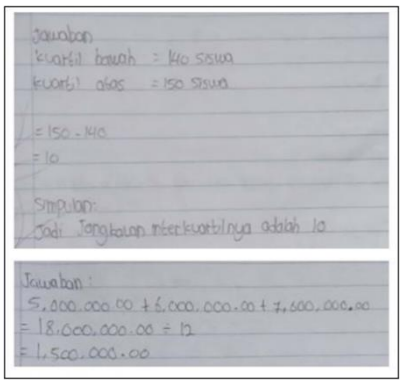
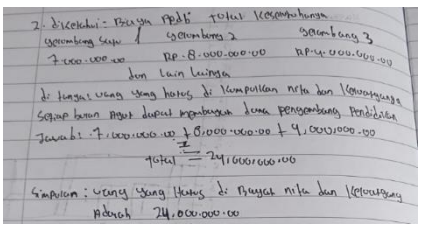
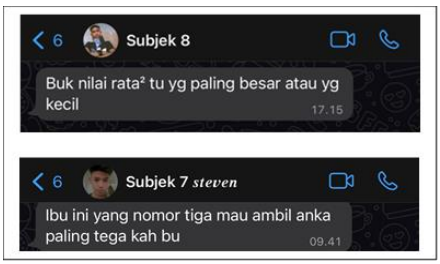
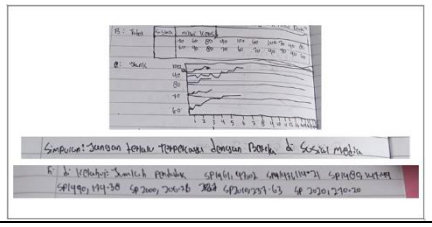
Based on the interview conducted via Google Meet, it was found that some subjects felt they had never been taught the material, while others stated that their teacher had indeed taught the material. This discrepancy indicates ineffective communication between teachers and students, resulting in learning that lacks meaningfulness. Consequently, subjects struggle to effectively communicate concepts such as mean, median, mode, and quartiles, which impairs their ability to solve related problems. This finding aligns with Akendita's (2025) research, which demonstrates a positive correlation between students' interest and teachers'

effective communication, and confirms that effective teacher communication significantly impacts students' mathematics performance.

Researchers also received information from subject four that the teaching materials used by Indonesian schools in Malaysia are Electronic School Books (BSE), including teacher books, printed student books, and companion books, for example, at CLC Kundasang using LKS books. Researchers observed the language of instruction used in the two teaching materials. Both types of books (BSE and LKS) only use Indonesian as the language of instruction.

Based on the analysis results written in the form of a description of the interview results script with the teacher and the results of the student's mathematical communication test, students' difficulties in understanding Statistics can be found based on the mathematical communication indicators presented in the following table.

Table 1 – Students' Difficulties Based on Mathematical Communication Indicators

Indicator	Interview	Test	Difficulty analysis
Communicate ideas using language or mathematical symbols appropriately.	However, if it is already in story form, even though the meaning is the same as going to surgery, this is what children still find challenging to understand. Because one thing I said earlier is that mathematical literacy is a language barrier. So this language is also what we know here. I also used the textbook from Indonesia; we used a mathematics book from Indonesia. So all the questions and language are Indonesian, while the children still lack understanding of what the word means, sir? What does this mean?	  	Do not correctly understand the language used in the test questions, including Indonesian and mathematical languages and symbols. Writing incorrect mathematical symbols, namely at dots and commas in the Rupiah value. Does not understand mathematical language.
Model or re-express situations into various forms of mathematical representation, such as	For example, in this book, the price is three thousand and five thousand. I try to make students understand how to calculate it first. I priced the item not in		Unable to read mathematical representations. Unable to make diagrams.

Indicator	Interview	Test	Difficulty analysis
images, tables, diagrams, or graphs.	Rupiah but in Ringgit. So when they understand how to calculate it, they should change it to Rupiah because it is tough to understand problems with large numbers, such as millions. Sometimes the zeros are missing when writing millions. Constraints at the CLC, such as teaching children in maths, find the material too difficult. From the content of the material and the textbook, the book is too difficult for us, mentor teachers, especially civil servant teachers. That is all. Not all mentor teachers are here. And not all mentor teachers in the CLC have mastered the basics of maths.		
Present well-organised and structured problem solving.	Students still find it challenging to understand what this means. Students often ask questions about the questions in the textbook.		Students cannot write the known information from the problem correctly. Students cannot organise problem-solving in a structured way.

3.2. Discussion

Based on research on the first indicator, the real condition experienced by Indonesian school students in Malaysia when studying statistics is that students have difficulty correctly communicating ideas using language or mathematical symbols. Piaget, in Cremers (1988), based on his research on children, revealed that the level of children's intellectual development starts from the level of sensory-motor development (Cremers, 1988). This level occurs from when the child is born until he is two years old. Children are active in sensory-motor schemata that regulate their senses and movements. Schemata are representations of perceptions, ideas, and actions, as a rationale for understanding new knowledge. At this level, children can barely abstract; they are still tied to something concrete (for example, the existence of objects that are touched or seen directly).

The second level of development is called pre-operational. This level occurs from when the child is eighteen months (one and a half years) to seven years old. Children's abstraction power gradually increases. Around the age of two, children begin to be able to interpret things symbolically. Until the age of seven, children can categorize (classify) objects based on specific

characteristics. Based on this description, it is clear that the child's intellectual development process starts from the senses he has until he can interpret things symbolically, whether knowledge comes from what he sees, tastes, hears, smells, or tastes. This means that the influence of the environment where the child lives contributes to their intellectual development. However, based on the facts, Indonesian school students in Malaysia live in Malaysia from birth, so the knowledge obtained by students from their senses follows what applies in Malaysia.

One of the symbolic realities that Piaget expressed in the book Cremers (1988) was language. Derwisyah (2022) emphasizes that language is a means of communication. The residence of Indonesian students in Malaysia (countries outside Indonesia) impacts differences in the use of the languages exchanged between teachers and students and between students and teaching materials. Two types of teachers teach Indonesian school students in Malaysia: development teachers and tutors. Teachers and teaching materials have been born and developed in Indonesia, while students are used to living and developing in Malaysia. This condition causes differences in the experience of using language in everyday life, including naming objects. As a result, students have different understandings of language and symbols (as well as terms) used in statistical learning, such as mean, median, quartile, range, interquartile, and so on, especially in the application of statistics in everyday life in Indonesia, for example, in the use of currency.

Teachers and teaching materials for statistical materials in everyday life often use Rupiah currency, which consists of more than three digits (thousands). While students are used to using Ringgit currency, which consists of a maximum of two digits, they rarely use Ringgit currency with a nominal value of up to thousands. Writing the Rupiah currency involves a zero-zero comma. This triggers student confusion because they are not used to reading or writing Rupiah signs, namely, point zero. The material explanations and question forms in the statistics books used by the Indonesian School in Malaysia involve Rupiah currency, even up to millions in nominal value, not Ringgit.

This condition shows a gap between the context used in learning and students' real daily experiences. In line with the findings of Copur-Gencturk and Doleck (2021), students' difficulties in understanding problems depend not only on their understanding of mathematical concepts but are also closely related to their strategic competence. The competences in question include the ability to mathematize real-life situations, choose appropriate representations, and develop appropriate solution strategies. In this context, differences in currency systems and number notations hinder understanding problems and solving problems, especially when students are unfamiliar with the forms of representation used in textbooks and are more accustomed to interacting with the forms of representation used in their daily lives.

Statistics is closely related to nominal currency; therefore, understanding currency calculations is important to understand statistical material. Apart from currency, naming several objects also has different meanings. For example, the word "lada" in Malaysia means "chili" while in Indonesia it means "pepper". Even in everyday activities, the meaning is different, for example, the word "credit" in Malaysia is often used in credit purchase transactions, while in Indonesia, the word credit is used in debt and receivable/installment transactions. This difference in language causes communication in schools to be ineffective because both parties have a low level of similar meaning in the message (Liliweri, 2011). Based on this description, it is clear that differences in the language used in everyday life cause students to experience difficulties when using mathematical symbols and language to communicate their ideas regarding statistics.

The difficulty of Indonesian school students in Malaysia in understanding and using the language of mathematics in statistical learning also influences their ability to model situations into various forms of mathematical representation. This has implications for students' low ability to interpret or present data in images, tables, diagrams, and graphs. As previously explained, the environment in which students live in Malaysia contributes to their intellectual development, in contrast to that in Indonesia. Interpreting the statistical concepts presented in the teaching materials, which have been designed for the Indonesian context, is a challenge that Indonesian school students in Malaysia must face.

This difficulty in mathematical representation is also explained in Piaget's theory. Piaget states that children are in the concrete thinking stage before achieving the ability to think abstractly. In the concrete operational stage, from the age of seven to eleven, children begin to understand the relationships between objects but still need real experience to understand the concept in depth. So, when students encounter less familiar terms and symbols, such as using the Rupiah currency in statistics learning, students have difficulty connecting these concepts with everyday experiences that are more accustomed to the Ringgit currency. These limitations in mathematical communication hinder students' ability to relate statistical concepts to real-life applications. For example, when presenting data about daily financial reports in tables or bar charts, students may experience confusion when determining categories and scales because they are unfamiliar with the units used. The difficulty continues when students are asked to analyze the data and draw conclusions.

The research results show that students also experience difficulties carrying out multiplication and arithmetic division operations. Piaget's theory explains that the third level of intellectual development begins around 11 or 12 years. Its characteristics are the development of formal and abstract operations. In an advanced cultural environment, these operations form one system of thought structures until they stabilize at 14 or 25. Such operational capabilities constructively enable the development of scientific knowledge, provided it is supported by an environment capable of providing practical opportunities and a conducive intellectual atmosphere.

According to Piaget, the child's mind involves various logical operations that underlie the system of group and relation concepts, arithmetic operations (addition, multiplication, etc. and vice versa), geometric operations (division, transfer, etc.), temporal operations (series of events, series arranging events sequentially and including intervals between events); etc. (Cremers, 1988). Piaget discovered that children's thinking becomes logical only through the organization of an operating system that follows general rules such as composition (two operations can be combined to produce one operation for example +1 + 1 = +2), reversibility (each operation can be reversed, for example +1 is reversed to -1), identical operations (the operation and reverse can be an identical or zero operation, for example +1 – 1 = 0), and operations combined with other operations.

Recent research by Lafmejani (2022) shows that children's cognitive development is not solely determined by biological age maturity as explained by Piaget, but is also greatly influenced by social, cultural, and educational factors. Although according to Piaget, formal and abstract thinking abilities begin to develop around the age of 11 in a supportive cultural environment, Lafmejani found that elementary school children can already demonstrate abstract or semi-abstract thinking in specific contexts when given appropriate stimulation. This finding reinforces that the environmental context is important in accelerating cognitive development. Therefore, teaching materials and learning strategies must consider the socio-cultural context, not to underestimate students' abilities.

The relationship between environmental stimulation and cognitive development is also reflected in the research of Bonyah, Larbi, and Owusu (2023), who developed a mathematical model to understand forgetting and memorizing in learning mathematical concepts. The article Mathematical Modeling of Forgetfulness and Memorization of Mathematical Concepts discusses the development of a mathematical model to understand the process of forgetting and memorizing in learning mathematical concepts. The analysis results show that forgetting occurs if students do not actively practice the material learned, emphasizing the importance of avoiding conditions that accelerate memory decay. These findings provide a mathematical picture that memory for mathematical concepts is greatly influenced by repeated practice, learning, and environmental stimulation.

This finding is reinforced by Formisano's (2022) research on neuropedagogy. Neuropedagogy is a field of science that studies how the brain learns and develops, and how knowledge about how the brain works can be applied in the teaching and learning process to make it more effective. Formisano found that the brain can modify its structure based on environmental stimulation. Several nerve centers, such as the hippocampus, which plays an important role in memory, show that neuron production can still occur even in adulthood. In addition, the brain shows the ability of plasticity to form new synapses and to restructure neural networks based on life experiences.

Recent findings in biology also indicate "gene expressivity," which is that gene expression is regulated by environmental factors throughout life. This process allows the brain to continually change and develop as a form of adaptation to learning experiences and environmental influences. Thus, new experiences and learning processes throughout life contribute to adjusting how well and quickly signals or information can move from one nerve cell (neuron) to another through synapses (i.e., the connection points between neurons). This emphasizes the importance of providing a supportive and challenging learning environment and encouraging learners to do repeated practice on the material that has been learned. This repetition process strengthens the connections between neurons and helps retain information in the long term. Therefore, learning strategies involving regular practice, active reflection, and contextual engagement are essential to maximize the potential for memory and understanding mathematical concepts.

Based on the results of studies from various journals, integrating Malaysian culture into teaching materials for Indonesian students in Malaysia is not an appropriate pedagogical approach. Maulida et al. (2021) emphasized that Indonesian culture must remain a significant part of the learning process in Indonesian Schools abroad because culture influences students' national identity. Hidayat et al. (2020) also showed that Indonesian local wisdom has excellent potential in shaping the character and readiness of students as global citizens without losing their national identity. This is in line with Misriani et al. (2023), who stated that learning based on Indonesian local wisdom can foster a sense of pride in one's language and culture, while preserving cultural heritage amidst the flow of globalization. Silalahi and Kusumo (2023) added that preserving local wisdom needs to be instilled early as a form of appreciation for Indonesia's cultural diversity.

The study results indicate the importance of paying attention to preparing teaching materials for Indonesian schools in Malaysia, such as e-books and e-modules (Weilyn et al., 2023). The teaching materials prepared need to be contextually relevant to the current environment in which students live, namely, in Malaysia. The teaching materials prepared must also contain local Indonesian wisdom. Through teaching materials, this approach not only supports the development of mathematical communication skills and encourages a

deeper understanding of concepts, but also strengthens pride in Indonesian students' culture of origin and identity.

Students' learning difficulties in understanding statistics are closely related to language barriers, notation systems, and students' daily experiences, which are different from the learning context used even in teaching materials. Difficulties in understanding statistical concepts can be minimized through a learning approach that is more contextual and adaptive to the student environment, for example, using the Ringgit currency or adjusting terms and symbols used in teaching materials to make them more familiar to students. Visual media also helps students understand the relationship between statistical concepts and their real-life applications. Using visual media helps develop their mathematical communication skills. This approach is expected to overcome students' learning difficulties in understanding statistics, improve students' mathematical communication skills, and support cognitive development. All three are according to the stages of intellectual development described by Piaget, while still adapting relevant teaching materials and containing local Indonesian wisdom conveyed by Lafmejani.

4. Conclusions

This study's findings indicate three main difficulties faced by Indonesian School students in Malaysia in understanding Statistics, with the primary focus on mathematical communication skills. First, they have not memorized the multiplication of one to ten. They are not used to carrying out integer operations, which result in miscalculations in operations involving numbers consisting of several digits (millions). Second, teachers feel that the material's content is too heavy, especially for teachers who are not mathematics education graduates. This impacts some students who ultimately feel they have never been taught to model situations using various forms of mathematical representation and mathematical terms such as quartiles. Third, there is a differences between the language students use in their daily lives while in Malaysia (Malaysian) with the language used in teaching and learning activities, textbooks, as well as questions about mathematical communication skills tests that are applied using the national language of Indonesia, namely Indonesian, as a result students have difficulty understanding the information provided.

These findings emphasize the importance of strengthening students' foundational skills in arithmetic. They also highlight the need for teaching approaches considering the students' language environment. Theoretically, the findings support the idea that mathematical communication is closely related to language proficiency and numerical fluency.

On a practical level, the results suggest developing bilingual teaching materials that include the Indonesian and Malaysian languages. Using bilingual resources can help overcome language-related challenges students face in international learning settings. Following this, teaching materials can be further developed to incorporate elements of Indonesian local wisdom. The choice of Indonesian local wisdom as a solution in this context is usually aimed at making the learning materials more contextual, relevant, and easier to understand for Indonesian students, even though they study abroad, such as in Malaysia. Moreover, local wisdom can also strengthen the cultural identity of Indonesian students living overseas.

Future studies are encouraged to explore teaching strategies that can improve students' understanding of statistical concepts through simple classroom-based interventions. Research can also focus on how teacher training programs can better support educators who do not have a background in mathematics education. Moreover, further research is needed on developing bilingual learning materials rooted in Indonesian local culture. These resources may

effectively support students' mathematical communication skills in multilingual environments.

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Conflict of Interest

The authors declare no conflict of interest.

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