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Written mathematical communication and self-confidence: A study of pre-service mathematics teachers

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Abstract: Written mathematical communication is an essential competency for pre-service mathematics teachers, yet limited studies have explored this skill among them. Prior studies have highlighted a correlation between communication skills and an individual's level of self-confidence. Because of that, this study aims to describe the written mathematical communication abilities and self-confidence levels of mathematics teacher candidates. The research involved 20 sixth-semester students of the Mathematics Education Program at Universitas Negeri Malang, with six participants selected through purposive sampling. Using a descriptive qualitative approach, the study was conducted in three phases: planning, implementation, and conclusion. Data were collected through a written mathematical communication test and a self-confidence questionnaire, and analyzed using triangulation to ensure reliability. The results showed that two students with high self-confidence achieved level 4 in written mathematical communication, three students with moderate self-confidence attained levels 2–3, and one student with low self-confidence reached level 1. These findings indicate that self-confidence plays an important role in students' written mathematical communication skills. Therefore, teacher education programs are encouraged to design learning activities that foster students' confidence in expressing mathematical ideas in written form. Further studies with larger samples and broader contexts are recommended to validate these findings.

Kata Kunci: written mathematical communication; self-confidence; pre-service mathematics teachers

INTRODUCTION

Communication is the verbal exchange of thoughts and ideas (Achir et al., 2017) and serves as a means of sharing ideas and clarifying understanding (Fadillah, 2015). Through communication, ideas can be reflected upon, refined, discussed, and developed, allowing students to exchange ideas and simultaneously clarify their understanding and knowledge gained through learning (Nugraha & Pujiastuti, 2019). Recognizing its importance, the National Council of Teachers of Mathematics (NCTM) includes communication as one of the process standards in mathematics learning principles (Khoiriyah et al., 2016). In this process, language plays a vital role, and mathematics itself can function as a language. According to Andini & Marlina (2021), mathematics is not only a tool for thinking but also a means to convey ideas

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concisely and accurately. Thus, communication using mathematics as a language is referred to as mathematical communication.

Mathematical communication is the process of conveying ideas and knowledge either in writing or orally (Dewi, 2014; Siskawati & Chandra). Mathematical communication is also defined as a dialogue or interaction that occurs in the classroom environment. During this dialogue process, messages containing the mathematical material being studied at that time are transferred (Lamonta et al., 2016; Wardhana & Lutfianto, 2018). According to Hodiyanto (2017), mathematical communication skills are divided into oral mathematical communication skills and written mathematical communication skills. Oral mathematical communication skills include speaking, listening, discussing, and exchanging opinions. Meanwhile, written mathematical communication skills include presenting in the form of graphs, tables, symbols, and equations in solving a problem. Both oral and written communication play an important role for students.

There are several important roles of mathematical communication for students. According to Samawati & Kurniasari (2021), communication can help students understand concepts, solve problems, express their thoughts, think critically, and communicate effectively both verbally and in writing. Additionally, by utilizing their mathematical communication skills, students can understand and interpret their understanding of mathematical problems, both in terms of calculations and in everyday life. Students can also exchange ideas and clarify their understanding and knowledge during the mathematics learning process through effective mathematical communication (Safitri & Sulistyaningtyas, 2024; Syafina & Pujiastuti, 2020).

Effective mathematical communication must meet several indicators. The indicators of communication skills mentioned by Hendriana et al. (2017) include expressing real objects, situations, and everyday events in mathematical models (pictures, tables, diagrams, graphs, algebra); explaining ideas and mathematical models (diagrams, tables, graphs, algebra) in everyday language; explaining and formulating questions about the mathematics being studied; listening, writing, and discussing mathematics; reading with understanding of written work; making conjectures, constructing arguments, formulating definitions and generalizations; explaining and formulating questions about the mathematics being studied. Meanwhile, according to Bernard (2015), communication ability indicators can serve as a reference for teachers in developing students' ability to communicate results related to mathematical problems in the form of images, graphs, and mathematical symbols used as tools in solving problems.

Good communication skills are related to a person's self-confidence. According to research by Damayanti et al. (2023), there is a significant positive relationship between a person's interpersonal communication and their self-confidence. Self-confidence is the belief or trust in oneself and one's ability to succeed. The belief in question is a person's belief that they will act in the right, appropriate, or effective way in overcoming a problem (Kunhertanti & Santosa, 2018). Self-confidence, also known as self-esteem, is one of the affective abilities (Fitayanti et al., 2022). According to Maulidya & Nugraheni (2021), self-confidence is an

attitude that demonstrates a sense of belief in one's abilities, which motivates and encourages them to participate in learning, thereby positively impacting their academic performance. In line with this, Kosim et al. (2020) state that students with self-confidence have a strong influence on the achievements they will produce.

The close relationship between students' self-confidence and learning achievement encourages self-confidence to become one of the important psychological structures to be studied to see the results of students' achievements during the learning process (Çiftçi & Yildiz, 2019). Moreover, self-confidence has a strong relationship with students' mathematical communication skills. According to Ilyas et al. (2024), self-confidence has a positive correlation with mathematical communication skills, including both written and oral forms. Students with greater self-confidence tend to express their mathematical ideas more systematically and logically in written form.Therefore, a teacher must also possess self-confidence and good written mathematical communication skills. Written mathematical communication skills are crucial for educators to assess students' mathematical understanding and develop follow-up strategies to enhance their abilities (Pantaleon et al., 2018). Meanwhile, self-confidence is also important for teachers as one of the indicators of fulfilling personal competence according to the Regulation of the Minister of National Education (Permendiknas) No. 16 of 2007 (Sukmawati, 2019).

A pre-service teacher must also possess self-confidence and good written mathematical communication skills (Pantaleon et al., 2018). This is important as one of the preparations before becoming a teacher who meets the required competencies. However, the reality in the field shows that prospective mathematics teachers still exhibit limited self-confidence and inadequate written mathematical communication skills (essential component of overall mathematical communication competence) (Hodiyanto, 2017) Observations reveal that many pre-service teachers struggle to explain, present, and interpret mathematical ideas in written form using appropriate language, symbols, diagrams, tables, or formulas. This issue becomes evident during teaching practice sessions when they use PowerPoint presentations, where some written representations—such as the use of variables in solving systems of linear equations in two variables (SLETV)—are not presented accurately. For instance, they often represent the variable x as “apple” and y as “orange,” whereas x should denote the value of an apple, for example, the price of one kilograms apple. These findings indicate that several indicators of students’ written mathematical communication skills have not yet been properly achieved(Hendriana et al., 2017).

The weakness of written mathematical abilities is not only found in the observations conducted but also reported in several previous studies. Some studies indicate that students often experience difficulties in accurately expressing mathematical ideas—such as using mathematical models, formulas, or symbols—when solving given problems (Riyadi et al., 2021; Rizta & Antari, 2018). As a result, the solutions they produce are often invalid. For pre-service teachers, this condition certainly deserves attention. A teacher must possess strong mastery of subject matter as part of fulfilling professional competence. Professional

competence is one of the four essential competencies that teachers are required to have (Sukmawati, 2019). Teachers' failure to write mathematical symbols accurately can lead students to misunderstand a concept. This occurs because the correct use of symbols serves as a fundamental basis for learning mathematical concepts (Kusgiarohmah et al., 2022). Therefore, pre-service teachers who fail to meet the indicators of good written mathematical communication skills can be said to have failed to fulfill their professional competence.

There have been several studies on self-confidence and mathematical ability conducted by other researchers. Some researchers have focused on fostering students' self-confidence (Ajayi et al., 2025; Tanjung & Amelia, 2017) or on examining the factors that influence students' self-confidence in mathematics learning (Bendol & Jr., 2025). Several studies focus on analyzing students' communication skills in specific types of learning (Hakim et al., 2024; Sholihah et al., 2025; Wulandari & Astutiningtyas, 2020) or on specific subjects such as geometry (Imanisa & Effendi, 2023; Pangaribuan et al., 2020; Riyadi et al., 2021), SPLDV (Syafina & Pujiastuti, 2020), and linear equations (Andria et al., 2024). However, no research has yet addressed self-confidence and written mathematical communication skills simultaneously with the subject of pre-service mathematics teachers. According to Pantaleon et al. (2018), written mathematical communication skills are crucial for educators to assess students' mathematical understanding and develop follow-up strategies to enhance their abilities. Therefore, it is necessary to investigate self-confidence and written mathematical communication skills among pre-service mathematics teacher students. This research is important to conduct in order to complement existing studies on self-confidence and mathematical communication skills, considering that there is still limited research discussing self-confidence written communication skills with pre-service teacher students as the subjects.

METHODS

This study aims to describe the written mathematical abilities of students and the self-confidence of pre-service teachers. Therefore, this type of research is descriptive qualitative research. The choice of this qualitative method was based on the research objective, which was to describe the written mathematical communication abilities and self-confidence levels of mathematics teacher candidates (Creswell, 2012, 2014; Fraenkel et al., 2012).There are three steps that need to be taken in this type of research, namely planning, implementation, and conclusion (Putri et al., 2024). In the planning stage, the researcher conducted observations and developed research instruments such as test items and interview guidelines. In the implementation stage, the researcher administered a self-confidence questionnaire and a written mathematical communication test to measure students' abilities. The researcher then conducted interviews with the selected participants. In the conclusion stage, the researcher drew conclusions based on the data obtained.

The sampling technique used in this study is purposive sampling. The researcher conducted the study on one class of pre-service mathematics teachers consisting of 20 sixth-semester students at Malang State University. The 20 students were then grouped into several

groups based on the similarity of their answers to the test questions to determine their written mathematical communication skills and self-confidence categories. The researcher then selected one student from each group for in-depth analysis. The selection was made by considering the completeness and clarity of the student's written mathematical communication, as well as their representativeness of the group's characteristics. This ensures that each selected subject reflects the typical features of the group in terms of written mathematical ability and self-confidence. Only one subject was selected from each group to enable an in-depth qualitative analysis. Since this study aims to describe students' written mathematical abilities and self-confidence, selecting one representative from each category provides rich, detailed data without unnecessary repetition.

The assessment indicators for written mathematical communication used in this study were modified from the Maine Holistic Rubric for Mathematics, written by the Maine Department of Education, and the Maryland Math Communication Rubric by the Maryland State Department of Education (Utami et al., 2021). The modifications were made according to the needs of the study. The aspects and indicators of written mathematical communication skills resulting from these modifications are presented in Table 1 below.

Table 1. Aspects and Indicators of Written Mathematical Communication Skills

Aspects	Indicators
Reading and understanding	Write down what is known and what is asked in the question using mathematical words or symbols completely, clearly, and correctly.
Creating mathematical forms	Use symbols, variables, or mathematical equations to model problems into mathematical sentences completely, clearly, and correctly.
Solving mathematical forms	1. Write down the procedures or steps for solving the problem completely, clearly, and correctly. 2. Use symbols, variables, or equations when writing the solution to the problem..
Concluding	1. Convert mathematical symbols, variables, or equations to the problem situation to write conclusions. 2. Write down conclusions and reasons when solving problems completely, clearly, and correctly.

The self-confidence questionnaire used in this study is Peter Lauster's self-confidence questionnaire, which consists of 40 statements, 20 favorable (positive) statements, and 20 unfavorable (negative) statements (Lauster, 2012). For each statement, there are four answer choices: very appropriate, appropriate, inappropriate, and very inappropriate. The lowest score for each statement is 1, and the highest score for each statement is 4. Therefore, the lowest total score for self-confidence is 40, and the highest total score for self-confidence is 160. The self-confidence categories used in this study are shown in Table 2 below.

Table 2. Categories of Self-Confidence

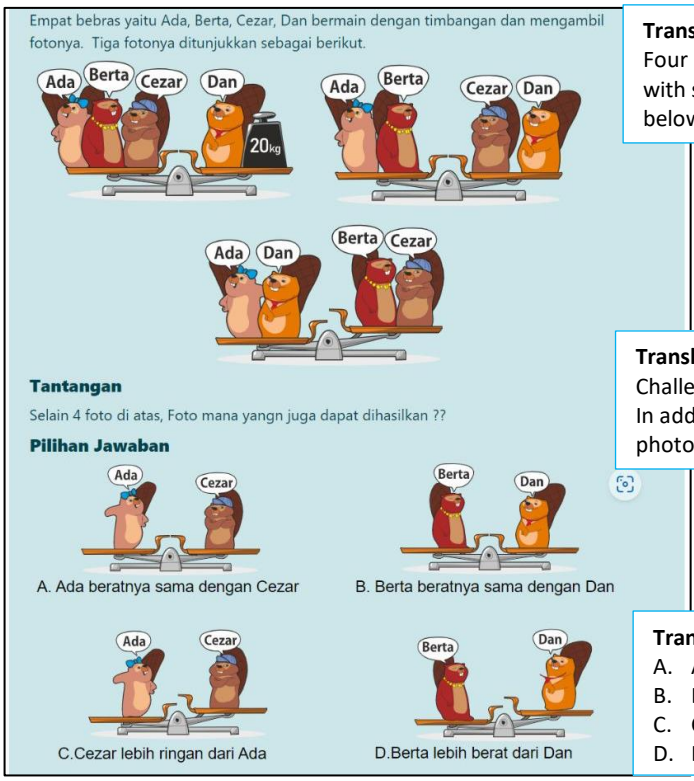
Total Score	Category
130-160	High
100-129	Moderate
70-99	Low
40-69	Very Low

After determining self-confidence levels, test results, and interviews, researchers analyzed the data. Data analysis was conducted using descriptive statistical techniques to determine students' self-confidence levels. Triangulation was performed using a combination of questionnaire results, written test data, and interview findings to ensure data validity and reliability.

RESULTS AND DISCUSSION

Results

During the preparatory stage, the researcher first conducted observations in a class of sixth-semester students majoring in Mathematics Education at Malang State University. During the observation, one of the student groups gave a presentation on mathematical games using integers. Through this observation, the researcher obtained information that the material presented, such as the writing of symbols and the use of equations, was still largely inaccurate. This resulted in incomplete or even inconsistent solutions to the problems. During the question-and-answer session, the attitudes and body language of some of the presenting students indicated a lack of confidence in the material they were presenting. They were unsure about the accuracy of the solutions they had written for the material they were presenting. For this reason, the researcher decided to investigate the written mathematical communication skills and self-confidence of pre-service mathematics teachers. Thus, at this planning stage, the researcher created all the data collection instruments needed for the study. These instruments include a self-confidence questionnaire in the form of a Google Form and a test on the material of four-variable linear equations and inequalities to assess written mathematical communication skills in printed form. Before being administered, the test items underwent a validation and revision process conducted by two mathematics education lecturers. The questions used as a test to assess students' written mathematical communication skills are presented in Figure 1 below.



Translation:
Four beavers, namely Ada, Berta, Cezar, and Dan, played with scales and took photos. Three photos are shown below.

Translation:
Challenge
In addition to the four photos above, which other photos can also be produced?

Translation:
A. Ada weighs the same as Cezar
B. Berta weighs the same as Dan
C. Cezar is lighter than Ada
D. Berta is heavier than Dan

Figure 1. Items for the Written Mathematical Communication Skills Test

The instructions for completing the questions are as follows:

1. Understand the questions above! Then write down what you know completely, clearly, and correctly! (Use words or mathematical symbols.)
2. Create a mathematical form or model of the problem!
3. Find the solution to the mathematical model you have created!
4. Conclude your answers!

After the researcher prepared all the necessary instruments, the researcher proceeded to the implementation stage. In this stage, the researcher collected data by asking students to complete a self-confidence questionnaire based on their circumstances and to solve the test questions above. During the data collection process, almost all students completed the tasks diligently and orderly, so the researcher did not encounter any significant challenges.

After the data was collected, the researcher processed the data by calculating the students' self-confidence scores and analyzing the answers from the test questions that had been given. The results of the self-confidence test showed that, out of 20 students, 3 had high self-confidence, 7 had moderate self-confidence, and 10 had low self-confidence. The researcher also measured students' written mathematical communication skills through a test administered based on a pre-prepared assessment rubric.Based on the results of this analysis, six groups of students were identified with similar or comparable types of answers from the test questions. The basis for determining the type of student answer was the extent to which each student's response met the aspects of written mathematical communication skills as described previously.The first to third groups consisted of students who could only meet two aspects (of varying degrees) of written communication skills. The fourth group consisted of

students who successfully fulfilled all four aspects using a systematic procedure. The fifth group consisted of students who only successfully fulfilled one aspect. Meanwhile, the sixth group consisted of students who successfully fulfilled all four aspects despite using trial-and-error techniques. The following are the results and discussion of the self-confidence and written mathematical communication conditions of pre-service teacher students from each group.

Student I

Student I represents the first group. The results of the test questions to assess written mathematical communication skills indicate that Student I has met the second and third aspects. The answers from Student I are presented in Figure 2 below.

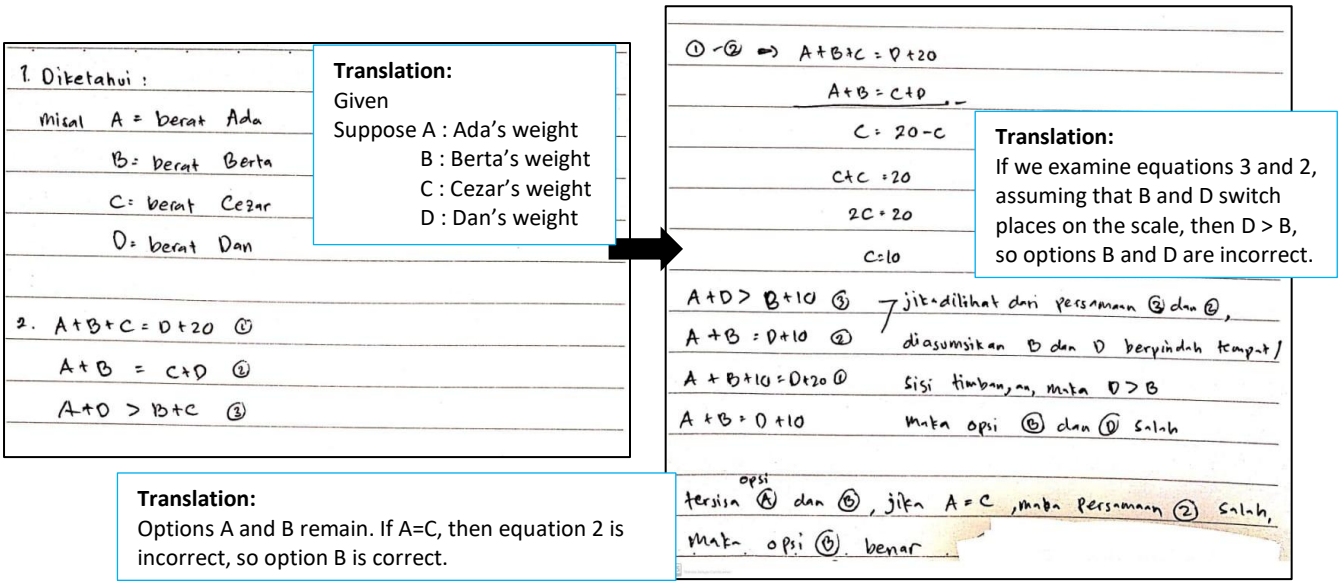


Figure 2. Answer Sheet of Student I

Figure 2 above shows that students have not yet fulfilled the first aspect of written mathematical communication, namely, reading and understanding. This condition is demonstrated by the students' inability to write down what they know from the given questions using mathematical symbols completely, clearly, and correctly. The student forgot the unit of weight (possibly kg, ounces, grams, or another unit) in the example they wrote. However, the student demonstrated the ability to use mathematical equations to model the problem into mathematical statements. This fact indicates that the student has fulfilled the second aspect, which is creating mathematical forms. The student has also been able to solve mathematical forms, which is the third aspect of written mathematical communication skills. This can be seen in Figure 2, which shows that they have successfully found the value of variable c and other equations that can be used to conclude. Despite having important information, the student failed to draw the appropriate conclusion. This is evidenced by the student's inability to evaluate each answer choice using the important information obtained from the question. As a result, the conclusion written lacks accurate reasoning. Therefore, it can be concluded that the student failed to fulfill the fourth aspect of written mathematical communication, which is concluding.

After reviewing the student's written mathematical communication results, the researcher examined the student's self-confidence questionnaire results. The questionnaire results showed that the student scored 123 points. This score indicates that the student falls into the moderate self-confidence category.

Student II

Student II represents the second group. The results of the test questions to assess mathematical communication skills indicate that Student II has met the second and fourth aspects. The answers from Student II are presented in Figure 3 below.

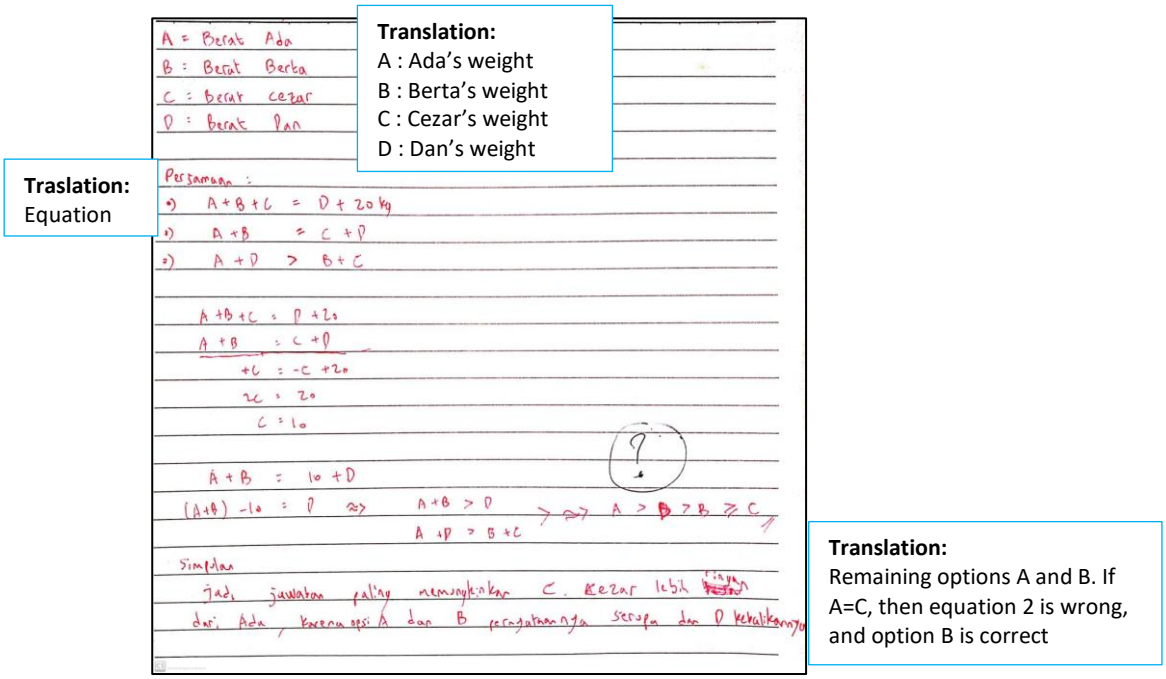


Figure 3. Answer Sheet of Student II

Figure 3 above shows that students have not met the first indicator of written mathematical communication. Students are not yet able to write down what they know from the given questions using mathematical symbols completely, clearly, and correctly. Like student 1, student II forgot to write down the unit information for each beaver weight in the example he wrote. However, the student has demonstrated the ability to use mathematical equations to model the problem into mathematical sentences. Unfortunately, the student failed to write down the procedures or steps for solving the problem completely, clearly, and correctly. The student successfully wrote down the information about Cezar's weight. However, the student failed to write down the additional information resulting from the processing of the equation he wrote. The student wrote an inequality whose accuracy is still questionable. This condition indicates that the student has not met the third indicator of written mathematical communication. In the third indicator, the student directly decided on an answer based on two inequalities, but the decision was illogical and did not include the reasoning behind the answer. Interestingly, although the answer he wrote in the third indicator was illogical, the conclusion he wrote was correct. Therefore, it can be said that the student successfully met the fourth aspect of written mathematical communication.

After reviewing the student's written mathematical communication results, the researcher attempted to examine the student's self-confidence questionnaire results. The questionnaire results showed that the student scored 113 points. This score indicates that the student falls into the moderate self-confidence category.

Student III

Student III represents the third group. The results of the test questions to assess written mathematical communication skills indicate that Student III has met the first and second aspects. The answers from Student III are presented in Figure 4 below.

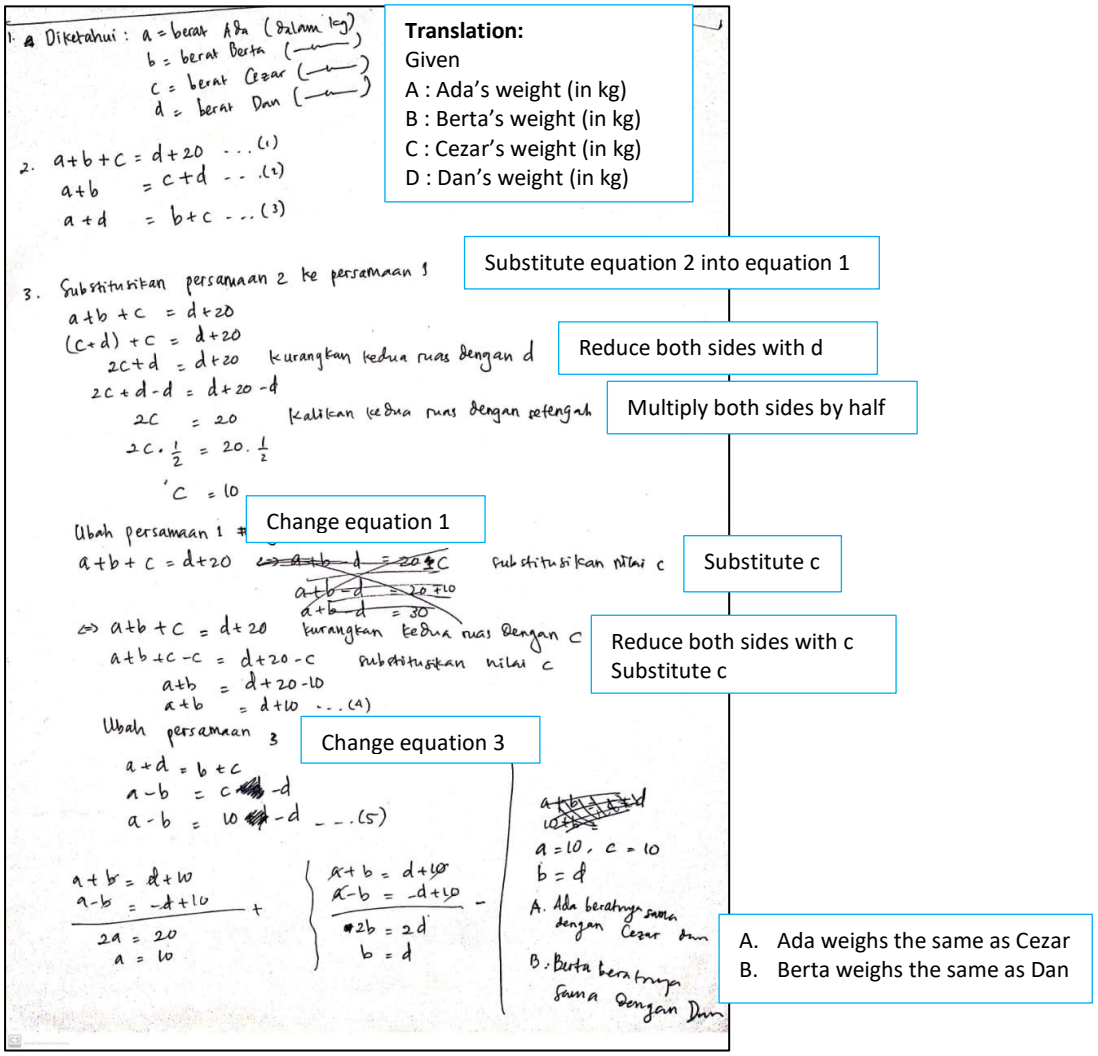


Figure 4. Answer Sheet of Student III

Figure 4 above shows that students have successfully fulfilled the first indicator of written mathematical communication. Students have been able to write down what they know from the given questions using mathematical symbols completely, clearly, and correctly. Third-year students have also been able to use mathematical equations to model problems into mathematical sentences. Thus, these students fulfill the second aspect, which is creating mathematical forms. Through the process of utilizing these equation forms, Student III has successfully found the value of variable c. However, the student encountered difficulties in

finding additional information that could be used to find the correct answer. This condition is shown by the student finding an incorrect value of 10. Therefore, the student can be categorized as failing to fulfill the third aspect. Thus, it is not surprising that the student also failed to conclude from the statements of the results he had previously processed. This resulted in the student failing to fulfill the fourth aspect, which is concluding.

After reviewing the student's written mathematical communication results, the researcher attempted to examine the student's self-confidence questionnaire results. The questionnaire results showed that the student scored 122 points. This score indicates that the student falls into the moderate self-confidence category.

Student IV

Student IV is one of the students who nearly achieved a perfect score on the test. The test answers assessing written mathematical communication skills indicate that Student IV met all aspects—the first, second, third, and fourth. The answers from Student IV are presented in Figure 5 below.

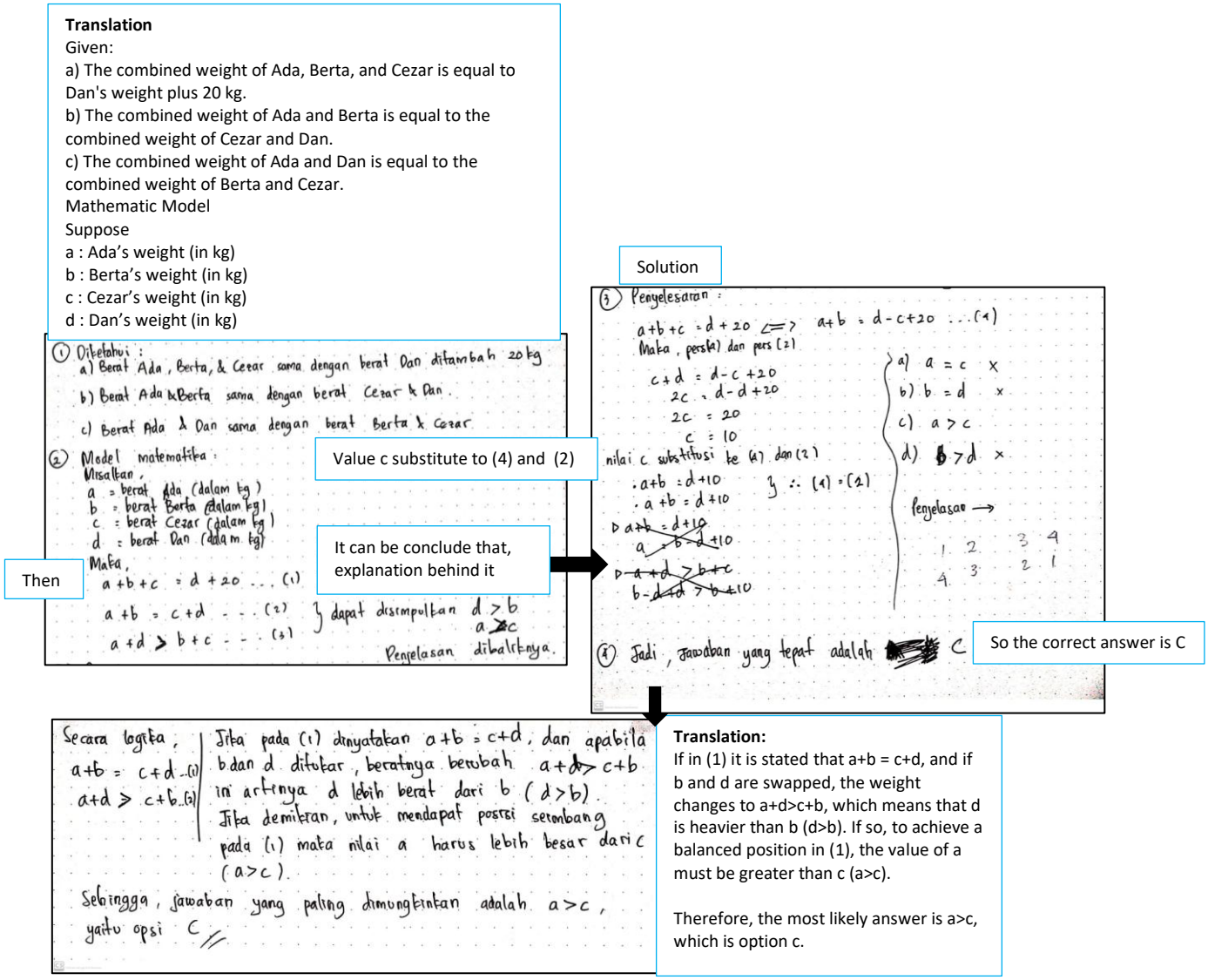


Figure 5. Answer Sheet of Student IV

Figure 5 above shows that students have successfully fulfilled the first indicator of written mathematical communication. Students have been able to write down what they know from the given questions using mathematical symbols completely, clearly, and correctly. Fourth-year students have also been able to use mathematical equations to model problems into mathematical sentences. Thus, these students fulfill the second aspect, which is creating mathematical forms. Through the process of utilizing these equation forms, Student IV has successfully found the value of variable c and also the additional information needed to conclude. Therefore, the student can be categorized as having successfully fulfilled the third aspect. The student has also successfully made the correct conclusion through the evaluation of additional information from the processing of the given information. Thus, the student can also be categorized as having successfully fulfilled the fourth aspect, namely concluding.

After reviewing the students' written mathematical communication results, the researcher examined the students' self-confidence questionnaire results. The questionnaire results showed that the student scored 139 points. This score indicates that the student falls into the high self-confidence category.

Student V

Student V represents the fifth group. The results of the test questions to assess written mathematical communication skills indicate that Student V only met the second aspect. The answers from Student V are presented in Figure 6 below.

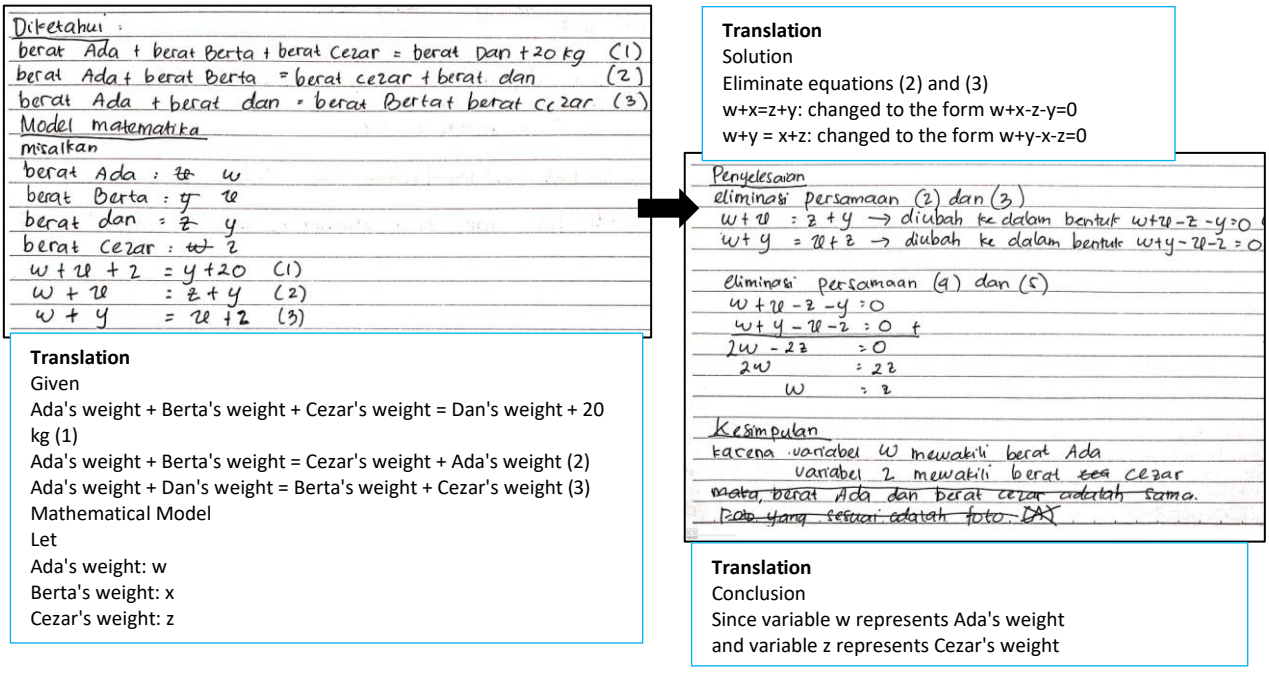


Figure 6. Answer Sheet of Student V

Figure 6 above shows that students have not yet succeeded in meeting the first written mathematical communication indicator. Students are not yet able to write down what they know from the given questions using mathematical symbols completely, clearly, and correctly. Students have not determined the unit of weight of beavers accurately. However, Student V

has been able to use mathematical equations to model the problem into mathematical sentences. Thus, this student has fulfilled the second aspect, which is creating mathematical forms. However, the mathematical forms obtained failed to be processed. This student has not been able to write down the appropriate procedures and strategies to determine the correct conclusion. As a result, this student failed to draw a conclusion that is logically and accurately reasoned. Therefore, Student V can be categorized as failing to fulfill the third and fourth aspects of the written mathematical communication indicator.

After reviewing the results of the student's written mathematical communication, the researcher attempted to examine the results of the student's self-confidence questionnaire. The questionnaire results showed that the student scored 89 points. This score indicates that the student falls into the low self-confidence category.

Student VI

Student VI is one of the students who nearly achieved a perfect score on the test. The results of the test questions assessing written mathematical communication skills indicate that Student IV met all aspects—first, second, third, and fourth. The answers from Student IV are presented in Figure 7 below.

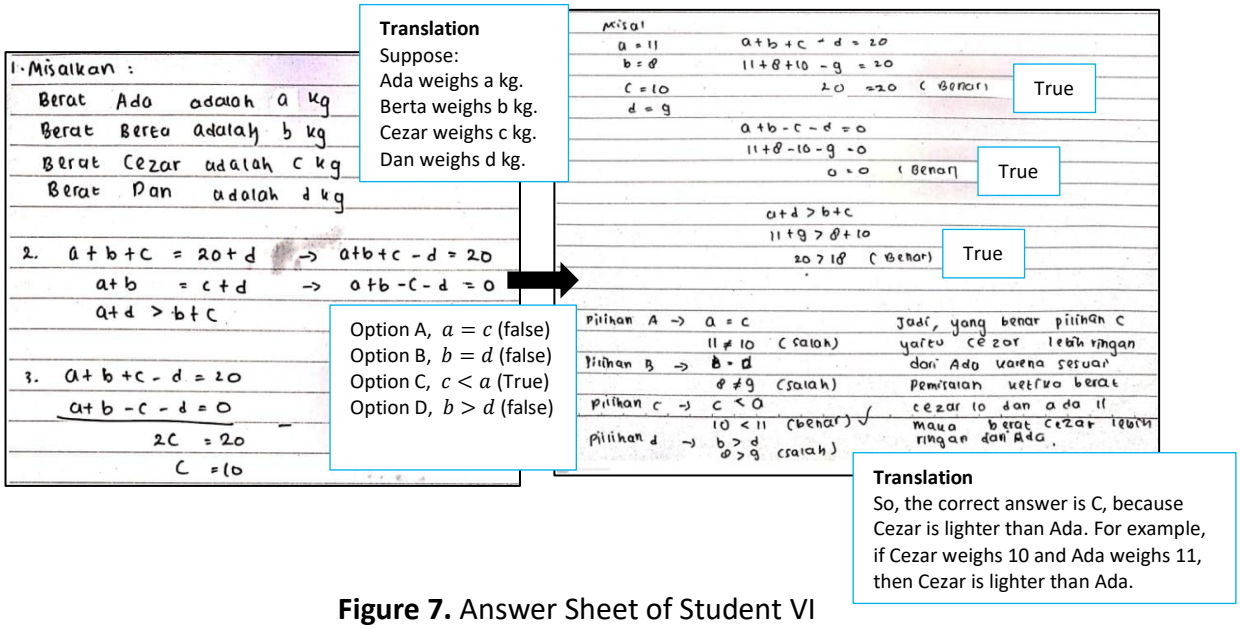


Figure 7. Answer Sheet of Student VI

Figure 7 above shows that students have successfully met the first written mathematical communication indicator. Students have been able to write down what they know from the given questions using mathematical symbols completely, clearly, and correctly. VI students have also been able to use mathematical equations to model problems into mathematical sentences. Thus, these students have fulfilled the second aspect, which is creating mathematical forms. Through the process of utilizing these equation forms, student IV has successfully found the value of variable c and used it to experiment with several numbers that match the known equation. Therefore, the student can be categorized as having successfully fulfilled the third aspect. The student has also accurately made the correct

conclusion through the evaluation of additional information from the processing of the information provided. Therefore, the student can also be categorized as having successfully fulfilled the fourth aspect, which is concluding.

After reviewing the student's written mathematical communication results, the researcher attempted to examine the student's self-confidence questionnaire results. The questionnaire results showed that the student scored 134 points. This score indicates that the student falls into the high self-confidence category.

Discussion

Based on the above analysis, the researcher found that only a few students were able to meet all four indicators of written mathematical communication skills well. Upon closer examination, several patterns were identified from the data obtained. Previous data showed that out of the six subjects, only one student had low self-confidence. This student was only able to meet one aspect of written mathematical communication. The student was only able to write down the mathematical model of the given problem. However, the solution strategy employed did not lead to the correct answer. According to Syarifah et al. (2017), students with such criteria still possess written mathematical communication skills at level 1.

Previous data also showed that out of the six students, three had moderate self-confidence. Each of these three students met two aspects of written mathematical communication. Although the two aspects in question still varied. In general, the three students had two types of errors: incorrectly evaluating answers due to calculation errors or choosing an inappropriate strategy. According to Syarifah et al. (2017), students with these criteria have written mathematical communication skills at level 2 or 3. Meanwhile, the other two students had high self-confidence and successfully met all four aspects of written mathematical communication well. Therefore, these two students can be categorized as having successfully achieved level 4, the highest level of written mathematical communication ability (Syarifah et al., 2017).

Based on the results described above, it can be seen that students with higher self-confidence tend to achieve higher levels of written mathematical communication. Specifically, the two students with high self-confidence were able to fulfill all four indicators, while those with moderate self-confidence only met two indicators, and the student with low self-confidence met only one. This pattern indicates a positive relationship between self-confidence and written mathematical communication ability. The more confident the students were, the more capable they were of expressing mathematical ideas accurately and completely in written form. Conversely, students with low self-confidence tended to hesitate in expressing ideas, which affected the completeness and correctness of their written answers.

Thus, the differences observed in written communication skills among the six subjects are closely related to their varying levels of self-confidence.This is in line with the research conducted by Noviyana et al. (2019), which states that students' mathematical

communication skills will be in line with their self-confidence. Students with good self-confidence will have the courage to express their opinions. Meanwhile, students with low self-confidence will tend to find it difficult to express their opinions, both verbally and in writing. However, there are several efforts that can be made to improve students' self-confidence and mathematical communication skills. One effort that can be made is to apply a GeoGebra-based PBL approach, as done by Andini et al. (2018).

CONCLUSION

Based on the research conducted, the researchers concluded that the higher the self-confidence of pre-service teacher students, the higher their level of written mathematical communication skills. Students with high self-confidence were able to achieve level 4 in written mathematical communication skills. Meanwhile, students with low self-confidence can only reach level 1.

This study has limitations related to the small number of subjects and the short duration of data collection, which may restrict the generalizability of the findings. Therefore, further research involving a larger and more diverse group of participants over a longer period is recommended. Future studies could also employ quantitative or mixed-method approaches to provide a more comprehensive and generalizable understanding of the influence of self-confidence on written mathematical communication skills.

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