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The mathematical communication failure of the students while solving problems reviewed from their characteristics

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Abstract: Mathematics communication could develop conceptual understanding and mathematics problem-solving and reasoning. An excellent mathematics communication influences the problem-solving of learners. The mathematics communication skill characteristics are rigorousness, economy, and freedom. This research aimed to describe the learners' mathematical communication failures in solving problems reviewed from the characteristics. This research is qualitative. There were 30 graders of VIII grade of Islamic JHS Maslakhul Huda, Sluke, Rembang. This research selected two learners that failed to communicate their problem-solving results based on the characteristics. The instruments to collect data were problem-solving tasks and interview guidelines. The findings showed that: (1) the learners that failed to communicate the problem-solving results only met the rigorousness and freedom characteristics, and (2) these learners only had rigorousness characteristics.

Keywords: *Failures, Mathematics Communication, Rigorousness and freedom*

INTRODUCTION

Mathematics communication has a crucial role in a mathematics lesson. Depdiknas (2013) states that mathematics must emphasize some aspects including mathematics communication. (Jung and Reifel 2011; Viseu and Olivera 2012; Inprasitha et al, 2012; Kaya & Aidyn, 2014; Karl W. Kosko, 2010) found the importance of mathematics communication. Jung & Reifel (2011) explain that mathematics communication could develop conceptual understanding, problem-solving, and mathematics reasoning. An excellent mathematics communication influences the problem-solving of learners. Viseu & Oliviera (2012) explain that mathematics communication has opportunities for learners to understand the discussed concepts. Inprasitha et al (2012) found that mathematics communication skills provided opportunities for learners to discuss problem-solving strategies. Mathematics communication could develop conceptual understanding, problem-solving, and mathematics reasoning (Kaya & Aidyn, 2014). This communication within discussion could encourage the learners' conceptual understanding (Karl W. Kosko, 2010). It showed that the learners' mathematics

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communication could socially interact and share ideas or notions. However, the findings on the field showed learners had difficulties communicating their mathematics ideas in written and spoken manners. Therefore, teachers must facilitate learners to express their mathematics ideas to other people (Cooke & Buchholz, 2005).

(ElSheikh & Najdi, 2013; And Yuniara, 2016) point out the low level of learners' mathematics communication. ElSheikh and Najdi (2013)found that the most observable hindrance in communication was mathematics material. It was because it consisted of many symbols and representations in the form of icons and pictures. Thus, learners encountered difficulties understanding. Yuniara (2016) found the learners had difficulties communicating the problem-solving results in their daily life. They also had difficulties arranging them into a mathematics model. It happened because the given problems did not contain non-routine matters. Thus, learners did not have anything to reflect, experiment, investigate, assume, and generalize. Nurlia (2015) found learners' lack of understanding about the mathematics materials and their passiveness during the lesson led to lower mathematics communication levels. Yusra & Saragih (2016) Found that the low mathematics communication level occurred when the learners had to explain the answers. They had difficulties explaining how they could get the answers. It was because they did not have a habituation opportunity to communicate their ideas or answers.

Kaya & Aidyn (2014) Mathematics communication could encourage the learners' understanding to solve problems. Lomibao et al. (2016) found that learners with the habit of solving problems and expressing their mathematics communication would have excellent achievements and better conceptual understanding. Therefore, mathematics communication effectively improved the learners' achievements, conceptual understanding, problem-solving, and relieving anxiety. Cooke and Bucholz (2005) explain that teachers must prepare teaching materials for their learners. It is important to facilitate them in solving problems and produce better communication.

Studies about mathematics communication characteristics are many. They are such as (1) Inprasitha et al (2012) that found learners taught by the opened-approach had mathematics communication characteristics within cognitive aspects. They were such as rigorousness, economy, and freedom. Besides that, the characteristics on the emotional aspect of the learners with emotional experience showed that in each learning stage, the occurring emotional experience was such as confident, joyful, attentive, and open-minded, (2) Kongthip et al., (2012) found that problem-solving results within the mathematics communication had some characteristics: (1) rigorousness through the beat gesture, (2) rigorousness through the metaphoric gesture, (3) economy through deictic gesture, (4) economy through the iconic gesture, and (5) freedom through deictic gesture, (6) freedom through the iconic gesture, and (7) freedom through the iconic and deictic gestures. Based on the previous findings, no theories discuss the learners' mathematics communication failures to solve geometric problems reviewed from their characteristics.

METHODOLOGY

This research is qualitative. There were 30 graders of VIII grade of Islamic JHS Maslakhul Huda, Sluke, Rembang. From thirty learners, two learners failed to communicate their problem results. They had characteristics of *rigorousness, economy,* and *freedom.* The data collection techniques were problem-solving tasks and interviews. The data analysis consisted of (1) providing a problem-solving based essay,

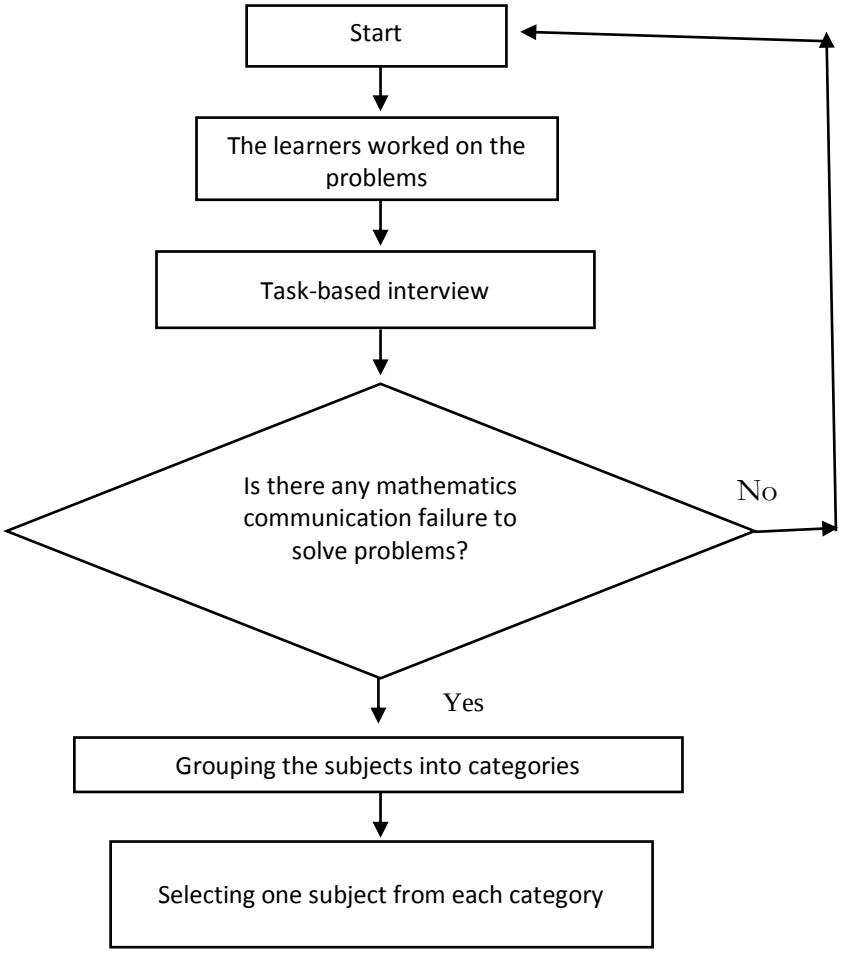

Figure 1. The research subject selection

(2) interviewing the subjects to confirm the learners' works, (3) grouping the research subjects based on the mathematics communication failures and their characteristics to solve problems Based on the explanations about the research subject selection stages, the results are shown in diagram 1.

RESULTS AND DISCUSSION

There were 30 graders of VIII grade of Islamic JHS Maslakhul Huda, Sluke, Rembang. From thirty learners, eighteen learners failed to communicate their problem-solving results. They also met the characteristics of rigorousness and freedom. The other twelve learners that

failed to communicate the problem-solving skills only met the characteristic of rigorousness. Then, this research selected one learner for each category that failed to communicate based on the characteristics. The results were S1 and S2 subjects. S1 failed to communicate the problem and met the characteristics of rigorousness and freedom. S2 failed to communicate the problem-solving result and met only the characteristic of rigorousness. Here are the explanations of every learner's category that failed to communicate their mathematics based on their characteristics.

1. **The explanation of S1 in solving geometric problems with rigorousness and freedom characteristics**

S1 admitted that his works in the form of written communication included. It included identifying the given and questioned matters, such as the pyramid volume = 96 m^3. Then, S1 made an analogy of the first pyramid height was 72m and the second pyramid height was 8 m. Then, he counted the base area. His designs obtained an area of the square. The base area in the first geometry was 4m^2. Thus, each side of the base was 2m. In his second design, the subject obtained the base area value of 36m^2. Thus, each side was 6m. The details are shown in figure 1.1.

Please design a pyramid with a square base with a volume of 96m^3 as many as possible.

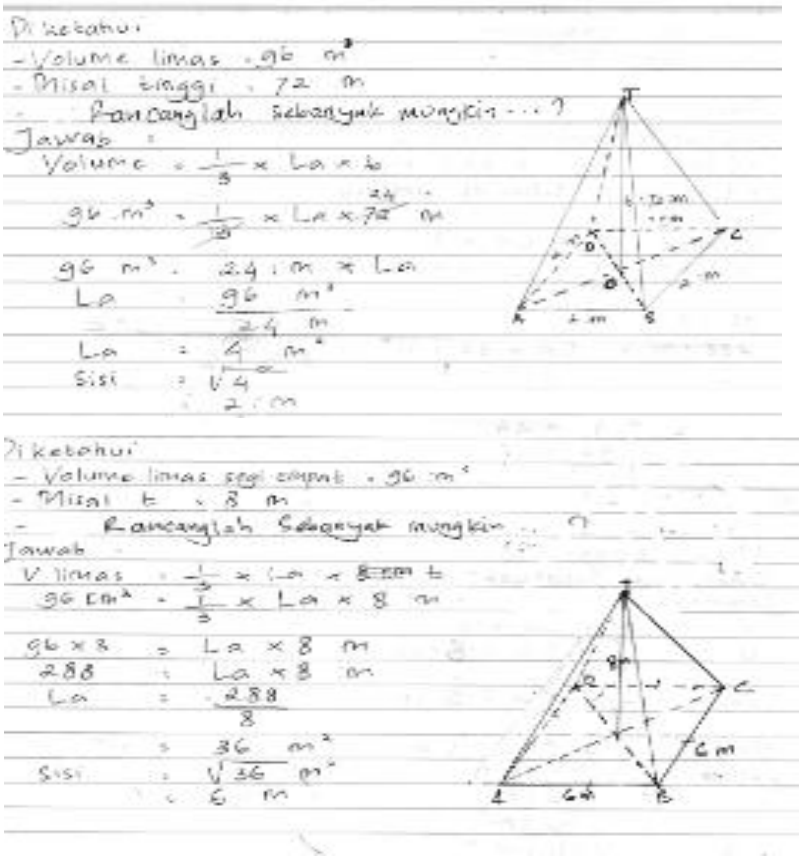

Figure 1. The explanation of S1's written text with *rigorousness* and *freedom* characteristics

S1 revealed his works in the forms of spoken text. This research obtained the data by interviewing the subject.

S01: Is there any information in the questions to facilitate you in solving the problems? Please tell me!

S02: There is. The pyramid volume is 96m^3.

P: Is there any other information?

S2: There is not.

P: In your opinion, how do you solve the question?

S2: I put the volume and the height of the pyramid into the formula. Then, I got the base and side areas to draw.

P: How did you find the height?

S2: I presupposed the height.

P: Is there any other pyramid height you determined?

S2: There is, sir.

P: Please tell me!

S1: the first pyramid height was 72 m, the second pyramid height was 8m.

Based on the works in figure 1 and the interview results, S1 read the questions and identified the given and questioned matters accurately. It showed that S1 solved the problems by expressing them into mathematics communication. Then, the result met the *rigorousness.* Then, S1 made an analogy of the first pyramid height was 72m and the second pyramid height was 8 m. It showed that the subject solved the problems and expressed them in mathematics communication. The results met the freedom characteristics while solving the problems. Polya (1973) Problem-solving is an effort to find a solution to a problem. It means to solve mathematics problems, it needs mathematics knowledge and experience. Wahyuningrum (2014) found that problem-solving provided opportunities for learners to discuss and share ideas to develop their mathematical communication skills.

2. The explanation of S2 in solving geometric problems with rigorousness characteristic

Here are the explanations of S2's works in the form of written communication: Identifying the given component, such as the pyramid volume = 96m^3. Then, the subject created an analogy of the pyramid height = 32m. Thus, the base area of the squared pyramid = 9m^2, and each side of the base = 3m. Here are the S2's works expressed into written communication in figure 2.

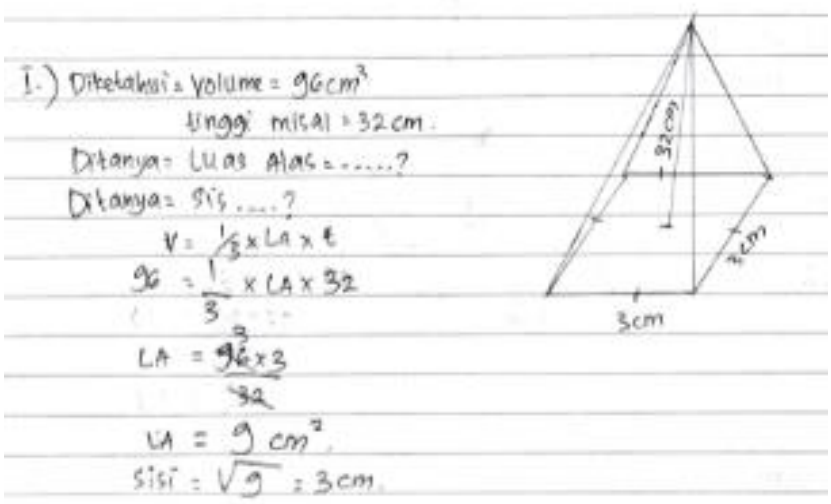

Figure 2 the written communication explanation of S2 with rigorousness characteristics

S2 could express the problem-solving results into spoken communication as shown in the interview results.

S01: Is there any information in the questions to facilitate you in solving the problems? Please tell me!
S02: There is. The pyramid volume is 96m^3.
P: Is there any other information?
S2: There is not.
P: In your opinion, how do you solve the question?
S2: I presupposed the pyramid height was 32cm.
P: Then, what did you do?
S2: I substituted the volume and the height of the pyramid into the formula. Then, I would obtain the base area and the sides to draw.
P: Is there any other pyramid height you determined?
S2: There is no, sir
P: In your opinion, what is the shape of the base?
S2: A square, sir.

The interview results showed that S2 expressed the works of the given matter correctly. It was the volume, 96m^3. The subject presupposed the pyramid height correctly. It was 32m. The subject could substitute the volume and the height of the pyramid into the formula. Then, the subject could obtain the base area and sides to draw. It was 3 cm. S2 drew the square pyramid appropriately based on the obtained sizes. It showed the subject expressed the problems and communicated the results with rigorousness characteristic. It was in line with Inprasitha et al (2012). They found learners taught by opened approach had a characteristic of rigorousness while solving the problems.

CONCLUSION

Based on the results and discussion, the learners that failed to communicate problem-solving results only met some characteristics. They were (1) mathematics communication by completing the problems with rigorousness and freedom characteristics, and (2) mathematics communication with only rigorousness characteristics. This research was limited only to the JHS and Islamic JHS learners. The next investigations should include the learners' mathematics communication failures to solve problems at primary, senior high school, and university levels.

REFERENCE

Cooke, B. D., & Buchholz, D. (2005). Mathematical Communication in the Classroom: A Teacher Makes a difference. *Early Childhood Education Journal*, *32*(6), 365–369.

Depdiknas. 2013. Kamus Besar Bahasa Indonesia Pusat Bahasa.Cet. Kelima. Jakarta : PT Gramedia Pustaka Utama

ElSheikh, R. M., & Najdi, S. D. (2013). Math Keyboard Symbols and Its Effect in Improving Communication in Math Virtual Classes. *International Journal of Information and Education Technology*, *3*(6), 638–642. https://doi.org/10.7763/IJIET.2013.V3.352

Inprasitha, P., Pattanajak, A., & Inprasitha, N. (2012). A Study of Student's Mathematical Communication in Teacher Professional Development. *Journal of Modern Education Review, 2*(1), 38–46.

Jung, H. Y., & Reifel, S. (2011). Promoting Children's Communication: A Kindergarten Teacher's Conception and Practice of Effective Mathematics Instruction. *Publication Cover Journal Journal of Research in Childhood Education*, *25*(2), 194–210. https://doi.org/10.1080/02568543.2011.555496

Kaya, D., & Aidyn, H. (2014). Elementary Mathematics Teachers' Perceptions and Lived Experiences on Mathematical Communication. *Eurasia Journal of Mathematics, Science & Technology Education*, *12*(6), 1619–1629. https://doi.org/10.12973/eurasia.2014.1203a

Karl W. Kosko, 2010. Mathematical Communication and Its Relation to the Frequency of Manipulative Use. *International Electronic Journal of Mathematics Education*, 5(2): 79–90.

Kongthip, Y., Inprasitha, M., Pattanajak, A., & Inprasitha, N. (2012). Mathematical Communication by 5th Grade Students' Gestures in Lesson Study and Open Approach Context. *Psychology*, *3*(8), 632–637. http://dx.doi.org/10.4236/psych.2012.38097

Lomibao, L. S., Luna, C. A., & Namoco, R. A. (2016). The Influence of Mathematical Communication on Students Mathematics Performance and Anxiety. *American Journal of Educational Research*, *4*(5), 378–382. https://doi.org/10.12691/education-4-5-3

Nurlia. (2015). Kemampuan Komunikasi Matematika dalam Pembelajaran MatematikaSebelum dan Setelah Penerapan Pendekatan Matematika Realistik. *Jurnal Daya Matematis*, *3*(5), 328–366.

Polya, G. (1973). *How to Solve It*. Princeton University.

Vale, I. & Barbosa, A., 2017. The Importance of Seeing in Mathematics Communication. *Journal of the European Teacher Education Network,* 12: 49–63.

Viseu, F., & Olivera, I. B. (2012). Open-ended Tasks in the Promotion of Classroom Communication in Mathematics. *International Electronic Journal of Elementary Educatio*n, *4*(2), 287–300.

Wahyuningrum, S. (2014). Association of Mathematical Communication and Problem Solving Abilities. *Implementation of MEAs Strategy in Junior High School*, *17*, 38–50.

Yuniara, R. (2016). Students' Mathematical Communication Skills in Finding the Concept of Direct and Inverse Proportions through. Discovery. *Proceedings of the 1st EEIC in Conjunction with the 2nd RGRS-CAPEU between Sultan Idris Education University and Syiah Kuala University, November 12-13, 2016, Banda Aceh, Indonesia,* 375–379.

Yusra, D., & Saragih, S. (2016). The Profile of Communication Mathematics and Students Motivation by Joyful Learning-Based Learning Context Malay Culture. *British Journal of Education, Society &Behavioural Science*, *15*(4), 1–16.