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Students' Mathematical Communication Skills In Solving Mathematical Problems Based On Learning Styles

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Abstract. Students' mathematical communication skills are still not optimal, this can be seen when students have difficulty in expressing their mathematical ideas in the form of writing or pictures. Students can understand the meaning of the problem given, but have difficulty communicating it again in the form of a mathematical model. This study aims to determine the mathematical communication skills of class VIII students in solving mathematical problems based on visual and auditory learning styles. The subjects of this study were eighth grade students of SMP Negeri 25 Semarang, each with one student with a visual learning style and one student with an auditory learning style. Data collection techniques used questionnaires to classify students based on learning styles, written tests, and interviews to determine students' mathematical communication skills. The validity test of the data used is triangulation technique by comparing the results of the written test and the results of the interview. The results of the study concluded that both students with a visual learning style and students with an auditory learning style have met the indicators of expressing everyday events into language or mathematical symbols and can explain ideas, situations, and mathematical relationships with real objects, pictures, graphs, and algebra . However, students with an auditory learning style have a higher level of accuracy than students with a visual learning style in writing mathematical symbols in the process of solving problems in solid-sided geometric material.

Key words: mathematical communication skill; learning style; solving mathematical problems.

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INTRODUCTION

Mathematical communication is often referred to as mathematical communication. Mathematical communication encourages students to be able to express their ideas about mathematics. Mathematical communication skills affect students in dealing with a problem (Yaniawati et all., 2019). It is a challenge for teachers to understand the different characteristics of students in order to develop communication, leadership and self-management skills while studying at school or university (Fedushko & Ustyianovych, 2020). Characteristics of different students, provide the opportunity for teachers to develop mathematical problem-solving skills by discussing mathematical concepts and sharing share ideas (Cheng et al., 2020). Mathematical communication is divided into two parts, namely written communication and verbal mathematical communication. If students have good oral and written mathematical communication skills, then they are easier to express ideas and strategies and are able to write down the stages solution to problems. (Maulyda et al., 2020).

A communication problem lies in the use of words. Word problems are one of the most difficult types of problems for mathematicians to deal with. Three important elements of the learning environment in the development of students' word problem-solving competencies are textbooks, software, and teachers (Verschaffel et al., 2020). The ability to solve problems is a very important part of the mathematics curriculum important. Problem-solving prioritizes the processes and strategies that students use in solving their problems rather than the results (Prismana & Pramudya, 2018). Students' mathematical ability is still low to solve contextual problems, this will certainly have an impact on student learning outcomes that are less than optimal. Therefore, teachers need to improve students' mathematical abilities in order to maximize learning outcomes through problem-solving through concepts related to real life (Lady et all., 2018). Real problem-solving is something meaningful because it provides an interesting experience for students. Creating a pleasant atmosphere and fostering creativity are the two most needed components in learning mathematics. Therefore, creativity will allow students to formulate something according to each student's learning style (Wahyudi et all, 2020).

Based on the results of an interview with one of the mathematics teachers at SMP Negeri 25 Semarang, information was obtained that students

had problems solving math problems. In addition, the communication skills possessed by students are also less than optimal. This can be seen when students are faced with contextual questions where students are asked to write down what is known and asked, so that mny students are still wrong in interpreting the meaning of the question. In addition, students also have difficulty in expressing their mathematical ideas in the form of writing or pictures. Students can also actually understand the meaning of the given problem, but have difficulty communicating it again in a mathematical form or model. As a result, students cannot solve the questions given by the teacher and students cannot provide an explanation of the answers correctly. According to research conducted by (Tambychik & Meerah, 2010) concluded that students face difficulties in solving mathematical problems due to their inability to acquire a lot of math skills and lack in cognitive learning abilities. According to the results of the study (Lu & Yang, 2018) concluded that there was a significant influence between visual learning styles on students' concentration. According to (Riyan Rizaldi et all., 2021) students with visual learning styles have better achievement scores than students with other types of learning styles

Therefore, the writer wanted to know the students' mathematical communication skills in solving mathematical problems based on visual and auditory learning styles. Which is later expected to be able to increase teacher knowledge in understanding student learning styles so that they can provide interesting alternative strategies for learning.

METHODS

The research method used is descriptive qualitative method which aims to determine students' mathematical communication skills in solving mathematical problems based on visual and auditory learning styles. This research was conducted at SMP Negeri 25 Semarang. Subject selection through purposive sampling where students were given a learning style questionnaire consisting of 30 questions then the results of the questionnaire were categorized into students with visual, auditory and kinesthetic learning styles. After that, the researcher chose one student with a visual learning style and one student with an auditory learning style according to the teacher's suggestion. Recommendations from the teacher are students who are communicative so that they can express their ideas and ideas, so that researchers can describe more deeply the subject under study and these students have received the material, namely the material for Building a Flat Sided Space. The next stage is the researcher conducts a written test of mathematical communication skills and conducts interviews with the research subjects. Data collection techniques using test and interview methods. The technique of checking the validity of the data is using the triangulation method. According to the triangulation process, this method is carried out by combining the results of written tests of mathematical communication skills with the results of interviews that have been conducted with predetermined indicators.

RESULTS AND DISCUSSION

In the early stages of the research, the learning style questionnaire, mathematical communication skill test and interview guide were validated first. The questionnaire is one of the most widely used tools for collecting data, especially social science research. Main the purpose of questionnaires in research is to obtain relevant information in the most reliable and valid way (Taherdoost, 2016). A valid test instrument is needed to evaluate the effect of certain learning treatments and to assess student competency (Herrmann et all, 2015). After all instruments were valid, 30 students from grade 8 were asked to work on a questionnaire to determine the grouping of students with visual and auditory learning styles. Based on the results of the questionnaire, the students who were used as research subjects were as follows:

Table 1. Research subject

No.	Code	Learning Styles
1.	SAL	Visual
2.	MWP	Auditory

After getting 2 research subjects, they were given a test of mathematical communication skills and interviews. The problem is as follows:

Is known:
Length (p) = 50 cm, width (l) = 40 cm, height (t) = 45 cm.
Asked:
a. Make a model of the building framework in question!
b. Determine the minimum length of wire needed to make 2 models of blocks!

Figure 1. Mathematical problems on the material of building a flat side space

Students with a visual learning style have higher class engagement compared to auditory and kinesthetic learners (Halif, 2020). Differences in learning styles have become an important consideration at all levels of education. The student's preferred learning style is useful for designing effective teaching methods (Chen, 2018).

Mathematical Communication Skill of Students with Visual Learning Style

Students with visual learning styles have fulfilled the indicators of expressing everyday events into language or mathematical symbols. The teacher must know the mathematical language used when teaching and students learn the language of mathematics through listening as well interact with teachers (Powell et all, 2019). Students' understanding of the language of mathematics in the form of symbols is a strong indicator of students' numeracy skills in solving a problem (King & Purpura, 2021). This is indicated by the SAL subject being able to describe the beam accurately, being able to calculate the completion correctly but being less precise in the use of units of length in the completion process. In addition, the subject of SAL fulfills the Indicator explaining mathematical ideas, situations and relations with real objects, pictures, graphs, and algebra. This can be seen based on the results of interviews, SAL subjects who are able to correctly answer how to draw blocks and can explain correctly how to find the length of wire needed in the problem. This is shown in Figure 2.

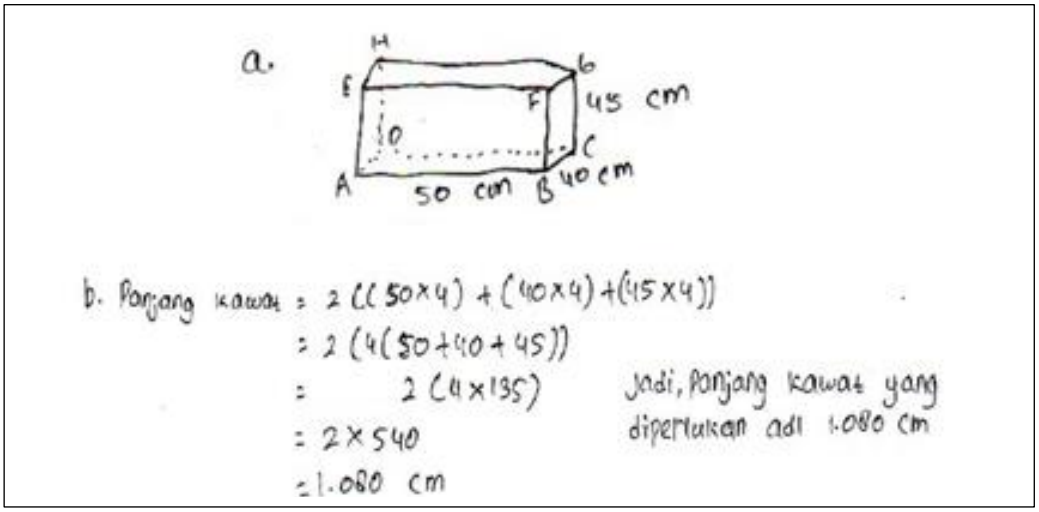

Figure 2. The results of students' answers with visual learning style

This is evidenced by the results of interviews with SAL subjects, as follows:

P-1 : Can you make a block frame model?
SAL : I can, Mrs
P-1 : Please show me.
SAL : Here, I made a model of the beam frame.
P-1 : How do you find the length of the wire?
SAL : Wire length = 2{(50×4)+(40×4)+(45×4)}=2{4(50+40+45)}=2(4×135)
=2×540=1.080 cm. So, the required length of wire is 1.080 cm.
P-1 : That means you directly find the wire length for two frame models at once ?
SAL : That's right, Mrs.
P-1 : Well, that's the correct result. However, it should be noted that in the use of units of length, it should still be written down during the calculation process.

Figure 3. Results of student interviews with visual learning styles

Mathematical Communication Skills of Students with Auditorial Learning Style

A teacher must understand the types of learning styles students in the class because this matter is very important to explore student learning styles so that they are more focused in the learning process and strategies in giving student assignments (Gilakjani, 2011). Students with auditory learning style are able to fulfill the indicators of expressing everyday events into mathematical language or symbols. It is shown that students with auditory learning styles are able to draw blocks, the use of symbols on the shape of the blocks is also appropriate and can solve problems correctly. In addition, based on the results of tests and interviews, it can be concluded that the MWP subject is able to fulfill the indicators of explaining mathematical ideas, situations and relations with real objects, pictures, graphs, and algebra. This is based on the results of the interview, the MWP subject is able to explain how to draw blocks correctly and explain how to find the length of wire needed in the problem. This is shown in Figure 4.

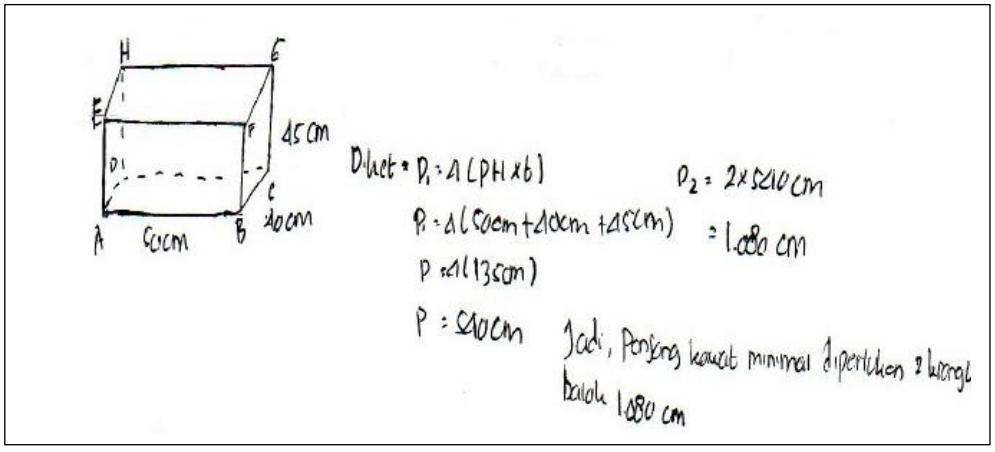

Figure 4. The results of students' answers with auditory learning style

Students with an auditory learning style not careful in solving the problem however they tend to think quickly. Another feature of this student is being able to write down the steps to solve problems systematically, but they do so incompletely (Apipah et al, 2018). Learning style refers to the ability of students to understand and process information in learning situations. One of The most important uses of learning styles are those that make it easy for teachers to incorporate them into their teaching (Vaishnav & Chirayu, 2013).

This is evidenced by the results of interviews with MWP subjects, as follows:

P-1 : Can you make a block frame model?
MWP : I can, Mrs
P-1 : Please show me.
MWP : Here, I made a model of the beam frame.
P-1 : How do you find the length of the wire?
MWP : Wire length = 4(p+l+t)= 4(50cm+40cm+45cm) = 4 (135cm) = 540 cm
Length of wire 2 blocks is 2 x 540cm = 1.080 cm
So, the required length of wire is 1.080 cm.
P-1 : That means you directly find the wire length for two frame models at once ?
MWP : That's right, Mrs.
P-1 : Well, a good answer because you have calculated correctly according to your method and are consistent in the use of units of length during the calculation process.

Figure 5. Results of student interviews with auditory learning styles

CONCLUSION

The results of the study concluded that both students with a visual learning style and students with an auditory learning style have met the indicators of expressing everyday events into language or mathematical symbols and can explain ideas, situations, and mathematical relationships with real objects, pictures, graphs, and algebra . However, students with an auditory learning style have a higher level of accuracy than students with a visual learning style in writing mathematical symbols in the process of solving problems in solid-sided geometric material.

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