Students' Mathematical Communication with the REACT Strategy assisted by Index Card Match in terms of Student Self Regulated Learning

***Wanda Mufida Ataria [1], St. Budi Waluya [2], Nuriana Rachmani Dewi (Nino Adhi)[3]**
University Semarang State, Indonesia

Abstract:
This research aims to describe students' mathematical communication abilities with the REACT strategy assisted by Index Card Match based on students' self regulated learning. This type of research is descriptive qualitative with random sampling technique. The population of this research were class VII students of SMP Muhammadiyah Daarul Arqom for the 2021/2022. The subjects of this research were six students based on high, medium and low self regulated learning categories. Two students were taken from the high self-regulated learning category, two students from the moderate self regulated learning category, and two students from the low self regulated learning category. The results showed that students with high self regulated learning categories were able to satisfy all three indicators of mathematical communication, students with medium self-regulated learning categories could only satisfy two indicators of mathematical communication, students with low self-regulated learning categories were only able to satisfy one indicator of mathematical communication.

Keywords : *Communication Mathematics, Self Regulated Learning, REACT, Index Card Match*

Correspondence Address : Kampus Pascasarjana UNNES Jalan Kelud Utara III, Semarang Indonesia
E-mail : wandamurfida21@gmail.com, telephone numbers +6282227438207

1. Introduction

Mathematics has a unique language. Capraro & Rupley in Juharani 2017 explains that mathematics has its own language in communication. According to NCTM 2000 (Hendriana, *et al.*, 2017) states that mathematical communication is an essential mathematical basic competence of mathematics and mathematics education. Without good communication, the development of mathematics will be hampered. Komba (2017) that communication is basically a process that involves sharing information. The symbol is a symbol or media that contains a

specific purpose and purpose. Scientific communication symbols can be tables, charts, graphs, pictures of mathematical equations and so on .

Independence is an attitude or behavior that is not easily dependent on other person in completing tasks (Daryanto & Damiatun, 2013). Zimmerman (Ozcan, 2015) said that students with independent learning skills are active motivationally, behavior, and metacognitive , consequently show that study independent is three dimension.

The REACT strategy is a learning strategy based on constructivism. The REACT strategy is a learning strategy based on the *Contextual Teaching and Learning (CTL*) approach which is structured to enable five forms of learning, namely *relating*, *experiencing*, applying, working together (*cooperating*), and transferring (*transferring*) . CORD in (Sari, *et al.*, 2018) states that the REACT strategy is based on contextual teaching structured learning strategies to encourage student involvement in class. Isnaini & Hendikawati (2015) explains that TAPPS learning REACT strategy is effective to ability communication mathematical student on sub material line offend circle . In addition to the REACT strategy, it can be combined with the Index Card Match (ICM) learning model . The ICM learning model is a cooperative learning model that works in groups. Syahrir (2017) explained that the percentage of classical completeness of student learning outcomes in the first cycle was 78.79% and increased in the second cycle, namely 87.89% by applying the index card match cooperative learning model which met the standard indicators of success .

Based on pre research observation at SMP Muhammadiyah Darul Arqom , students experience difficulty in solving match problems. Many students have difficulty communicating their thoughts, ideas, and idea.. The results of a preliminary study on mathematical communication skills in the sub-chapter of linear equations and inequalities of one class VII variable showed that the mean of the class studied was 64.125, the standard deviation was 9.396 and the number of students was 36 students. The following is the result of student work in Figure 1.

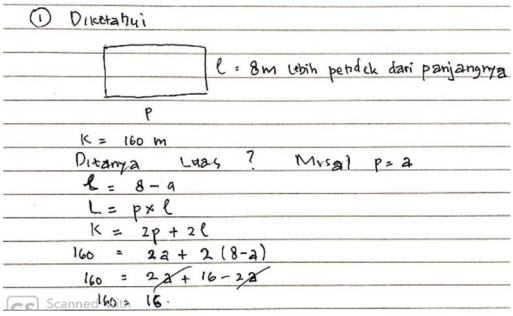

Figure 1Student Worksheet A

It can be seen that Student A has been able to model the problem in the form of symbols such as examples, students write down what is known and what is asked. However, students have not been able to solve the problem because the example in the area of the rectangle is wrong. This shows that students still have difficulty communicating their ideas and ideas through mathematical symbols (Paridjo & Waluya, 2017). Rohid ., *et al* (2019) which stated that student's mathematical communication abilities still need to be developed . Students' mathematical communication skills rarely get attention. The teacher is more trying so that students are able to answer questions correctly without asking for reasons or student answers. Students still find it difficult to communicate mathematics orally and in writing. The results of interviews with mathematics teachers at SMP Muhammadiyah Darul Arqom students tend to be passive in learning. They are only fixated on examples of questions of the same type when given by the teacher as well as when given assignments they only copy friends, but when given questions of a different type than the examples given they cannot work on them. Students only receive information and memorize it, so they do not understand the information they receive. Based on the description of this research, it will describe students' mathematical communication abilities in terms of self-regulated learning..

1.1 The Linkage between Students' Mathematical Communication Ability and Self Regulated Learning

Mathematical communication skills and self-regulated learning are important cognitive and affective abilities in learning. Mathematical communication skills are abilities in terms of explaining an algorithm and a unique way of solving problems. Mathematical communication skills become important when discussions between students are carried out, where students are expected to be able to state, explain, describe, listen, ask, and work together so as to bring students to a deep understanding of mathematics.

The importance of mathematical communication skills requires self-regulated learning which students should have. Self-regulated learning (SRL) is an attitude of self-regulation so that students can manage their learning, monitor themselves in learning and evaluate the learning process with the aim that students can find learning strategies, understand the content of subject matter, develop and improve their learning abilities in solving a problem. This is in accordance with the opinion of Oktaviana & Dewi NR (2020) which states that self-regulated learning is self-regulation to achieve learning goals. If SRL ability is low, it causes students to have difficulty solving their problems in learning, giving rise to behavior that is not independent in

learning. Students who have good mathematical and SRL communication skills will have no difficulty in learning. Particularly in the indicators of self-regulated learning , namely evaluating the process and learning outcomes can affect students' mathematical communication. Students can convey mathematical ideas to solve mathematical problems. Students can also manage their study hours efficiently and can evaluate the learning process they are doing to achieve their goals, so that students have no difficulty understanding the content of the subject matter.

2. Methodology

This type of research is descriptive qualitative with random sampling technique . The population of this research were class VII students of SMP Muhammadiyah Daarul Arqom for the 2021/2022. The subjects of this research were six students based on high, medium and low self regulated learning categories. Two students were taken from the high self-regulated learning category, two students from the moderate self-regulated learning category, and two students from the low self-regulated learning category. The instruments used in this research were tests of students' mathematical communication abilities and self-regulated learning questionnaires and interview guidelines about self-regulated learning.

3. Results and Discussion

There are three indicators of student mathematical communication used in this research, namely (1) expressing mathematical ideas through speech and writing, (2) interpreting and evaluating mathematical ideas in other forms, (3) using terms, mathematical notation and structures its structure for presenting ideas, describing relationships with situational models. Based on the results of the self regulated learning questionnaire, 6 students were selected as informants to be interviewed. The criteria chosen were high self-regulated learning (score $\geq$ 100), moderate self-regulated learning (score $\leq$ 99), low self-regulated learning (score $\leq$ 88). The results of the classification of self-regulated learning with coding can be seen in Table 1.

Student Code	Questionnaire Score	Criteria
E-02	107	Tall
E-08	102	Tall
E-01	91	Currently
E-07	95	Currently
E-05	85	Low
E-19	87	Low

Table 1Categories of Research Subjects

The research subjects were then grouped into categories of students' mathematical communication with high self-regulated learning (score> 90), moderate (79 ≤ value ≥ 89) and low (value < 79).

3.1 Mathematical Communication Students with High Self Regulated Learning

Subjects in the category of mathematical communication with high student self-regulation were selected for Subject E-02 by obtaining a questionnaire score of 107. The following is the result of students' mathematical communication work on Subject E-02 in Figure 2.

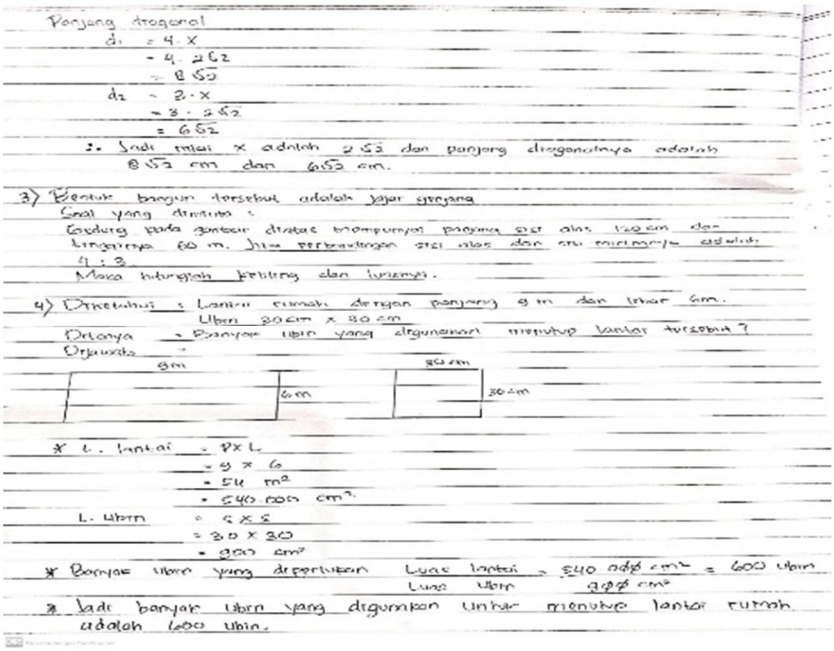

Figure 2Student Work Results Subject E-02

Based on the results of observations on subject E-02, it was shown that in question no 3 students were able to express the image into a story problem. Subject E-02 showed that in question no 2 students wrote down what was known, asked, and drew an ABCD rhombus. Students can interpret and then evaluate these answers by making conclusions. Subject E-02 demonstrates mathematical notation and its structures for presenting ideas. Subject E-02 can write down what is known, asked, and write formulas, and relate relationships from answers that have been answered. Students' mathematical communication based on high self-regulated learning can be seen at the second to last meeting students are able to take part in the learning and the use of the REACT strategy with the Index Card Macth makes them happy and feel engrossed, students are brave in conveying their ideas that they have when learning takes place , even though at the first meeting the students were not very interested

in the learning that the researcher applied. This is in accordance with the opinion of Qadri., et al (2019) stating that the REACT strategy is an alternative to change the situation to be more effective. Students have a positive perception of the REACT strategy even though it takes time to complete the lesson (Quainoo, et al., 2021). Based on the results of the interviews, it showed that students were able to solve problems in the questions given. Students with high self-regulated learning will make students able to improve their abilities, students can come up with new ideas in solving problems. Self-regulated learning in cognition and behavior is an important aspect of learning and the extent to which students become self-regulatory in learning will affect their academic success (Munahefi, et al., 2018). Mulyani., H (2015) also stated that students who have good mathematical communication skills also have good learning independence. Through communication, students are able to organize, contemplate and clarify ideas, relationships, mathematical thinking and mathematical arguments (Vale, I & Ana B., 2017). This is consistent with research by Lomibao., et al (2016) that students positively agree that mathematical communication is useful for students. Independent learning can support the improvement of students' mathematical communication skills.

3.2 Mathematical Communication Students with Medium Self Regulated Learning

Students who were selected as research subjects were in the moderate self-regulated learning group, namely E-07, by obtaining a questionnaire score of 95. The following is the result of the mathematical communication work of Subject E-07 students in Figure 3.

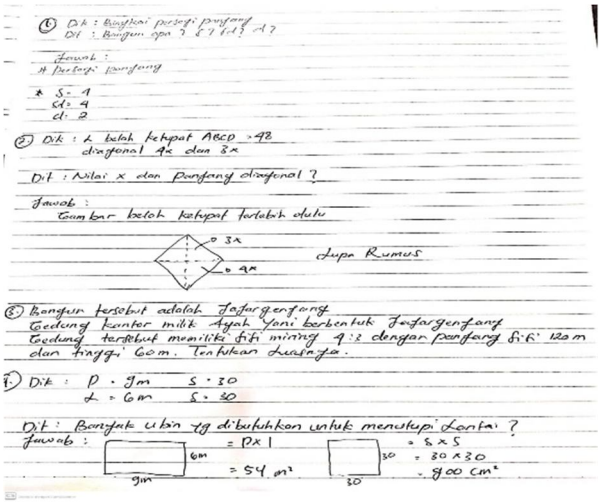

Figure 3Student work results Subject E-07

Based on the observations of Subject E-07, it was shown that Subject E-07 could express mathematical ideas through speech and Subject E-07 showed that in question no 1 Students expressed mathematical ideas through writing by describing the frame and then coding it to find out the number of angles and diagonals. Then write down the area and perimeter formulas. Subject E-07 has not been able to work on the second indicator question, namely interpreting and evaluating mathematical ideas in other forms. Subject E-07 was only able to write down what was known and answered and described the situation correctly. However, it has not been able to interpret and evaluate mathematical ideas into other forms. Subject E-07 was able to work on the third indicator of students' mathematical communication, namely using terms, mathematical notation and its structures to present ideas, describe relationships with situation models. Subject E-07 is able to use the terms of mathematical notation by presenting the idea in pictures. Students write down what is known and asked then answer it. Subject E-07 only fulfills the first and third indicators of mathematical communication. Because students did not meet the second indicator because they did not work on the questions to the fullest. Based on this description, it can be concluded that students' mathematical communication based on self-regulated learning is feeling doubtful in working on questions that are considered difficult.

The use of the REACT strategy with Index Card Match at the first meeting and the two students liked the discussion and the paired card game. The REACT strategy with Index Card Match can enable students to convey their mathematical ideas. According to Jelatu., et al (2018) stated that the REACT strategy emphasizes a deep understanding of the material being taught, and links with the real world, and allows students to teach themselves through concrete experiences. REACT is also teaching that contributes to improving student achievement (Akay & Sedat., 2021). However, at the last meeting there were some students who were afraid to express their opinions because they were unsure of the answers they had, so that students' self-regulated learning decreased. Self regulated learning has an important role in the success of students working on the questions given. With self-regulated learning, students are required to have activeness and initiative in learning, students believe in their own abilities (Sudianto, et al., 2019). Authary., N (2018) states that the effect of self-regulated learning on learning is very large. Because of the nature of self-regulated learning which is dynamic (cannot be separated from change) allows students to improve and improve independence.

3.3 Mathematical Communication Students with Low Self Regulated Learning

Subjects in the mathematical communication category with low student self-regulation were selected for Subject E-19 by obtaining a questionnaire score of 87. The following is the result of the mathematical communication work of Subject E-19 students in Figure 4.

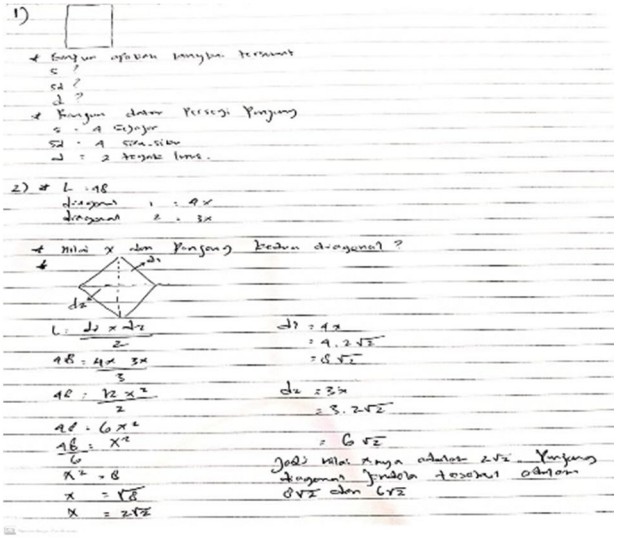

Figure 4Answers Subject E-19

Based on the observations of Subject E-07, he was not able to work on mathematical communication problems. The first indicator was expressing mathematical ideas through speech and writing. subject E-19 on question no 3 students did not answer the question. Subject E-07 is able to work on mathematical communication problems. The second indicator is interpreting and evaluating mathematical ideas in other forms. Subject E-07 showed that in question no 2 students were able to answer the question by applying the formula from the rhombus which was then used to find the value of x and the lengths of the two diagonals of the window. Subject E-07 has not been able to work on mathematical communication problems. The third indicator is using terms, mathematical notation and its structures to present ideas, describe relationships with situation models. Subject E-07 in question no 4 students cannot count the number of tiles required to cover the floor. Students with low student self-regulated learning can only fulfill 1 indicator of the three indicators of mathematical communication. Using the REACT strategy with Index Card Match during the second to last meeting students did not pay attention to the learning process. Students do not discuss optimally. At the first meeting, only some students dared to convey their mathematical ideas, students waited for help from friends when they had difficulties, so that students' self-regulated learning decreased. This is because students with low self-regulated learning feel insecure about the abilities students have. Low self-regulated

learning will affect students' mathematical communication. This is in accordance with the research of Lestari Ayu., et al (2021) which states that students with low self-regulated learning even though assisted by learning models will not have a positive effect, this happens because students with low self-regulated learning are less able to take part in demanding learning activities active students.

4. Conclusion

Based on the results of the research it can be concluded that (1) students with high self-regulated learning categories are able to fulfill the three indicators of mathematical communication, namely expressing mathematical ideas through speech and writing, interpreting and evaluating mathematical ideas in other forms, using the terms mathematical notation and its structures to present ideas describing relationships with situational models, (2) Students in the medium self-regulated learning category have not been able to fulfill the three indicators of mathematical communication, can only fulfill two indicators of the mathematical communication and (3) Students with low self-regulated learning category is only able to meet one indicator of mathematical communication. Two indicators of mathematical communication cannot be met by students.

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