THE ABILITY TO COMMUNICATE IDEAS OF STUDENTS IN THE COURSE TEACHING AND LEARNING STRATEGY

Nia Wahyu Damayanti
Universitas Wisnuwardhana
INDONESIA
wahyu_nia07@yahoo.co.id

Purwanto
Universitas Negeri Malang
INDONESIA
purwanto.fmipa@um.ac.id

I Nengah Parta
Universitas Negeri Malang
INDONESIA
nengah.parta.fmipa@um.ac.id

Tjang Daniel Chandra
Universitas Negeri Malang
INDONESIA
tjang.daniel.fmipa@um.ac.id

ABSTRACT

Communication ability is essential in our life. Without communication, we couldn't interact well with other people. Communication can help us to get new knowledge and open our mind. This study aims to obtain a representation of students' communication skills in expressing mathematical ideas in lectures of Teaching and Learning Strategy Mathematics. Students communicated the idea of mathematical ideas during lectures such as during presentations, ask questions, answer lecturers' questions and when they provide arguments about matters relating to the realm of mathematics. The method used in this study was a descriptive method. The subject for this research was the student in college which took teaching and learning lecturer. The results showed that students had shown various ability to communicate their mathematical ideas in aspects of writing their understanding about mathematical concept and representation. They describe the mathematical notion they have in the form of a chart containing a concept map of the set. They created a diagram of the content of the set that includes how to declare the set, the set type, the relationship between the set and the set operation. Students discussed together to discuss the application of Bruner theory at the enactive, iconic and symbolic stage. Students calculated the area of the classroom based on the number of ceramics in the classroom. In the iconic stage, they calculated the area of the existing rectangle in the plotted image. At the symbolic stage, they can write that the area of the rectangle = p x l

Keywords: Communication ability, Teaching strategy.

INTRODUCTION

Communication ability is vital in our life. Every human in the world needs to communicate with other people. Communication is one of aspect in process standards from principles and standards for school mathematics. One crucial issue that must be owned by a teacher or prospective math teacher to be able to deliver the material well is the ability of communication. Communication is an essential element of mathematics learning (NCTM, 2000). Communication means trying to understand and provide feedback to the speaker's message (Nillson and Ryve, 2010). Communication is one aspect of the mathematical process (Hunsader et al., 2014). The purpose of mathematics education is the communication of mathematics itself (Ernest, 1991). Students need to learn to communicate in mathematics (Australian Education Council, 1991). This is because with excellent communication skills they can reflect on learning outcomes and build on their experiences. Learning from pre-kindergarten through the 12th grade should enable students to be able to create and use representations to organize, record, and communicate mathematical ideas.

The process of communicating, in the world and the mathematics classroom, help us clarify our understanding. By observing we mean talking, listening, watching, writing, and demonstrating (Hiebert, 2003). Communication through peer interaction is useful in many ways. When students work with theirself, they tend to get "locked into" a particular form of thinking. However, when they communicate with others, they can improve their thinking and free up their thinking patterns so they could look at alternative ways of solving a problem. The ability of mathematical communication is the ability to (1) manage mathematical thinking; (2) communicating logical and excellent ideas to others; (3) identify and assess mathematical thinking and strategies used by others; and (4) using mathematical language to express ideas appropriately (NCTM, 2000). Shield & Galbraith (1998) states that students can communicate their explanations of mathematical strategy solutions in various ways, i.e. symbolically (numerical and algebraic symbols), verbally, in diagrams, graphs, or by data tables.

LITERATURE REVIEW
Communication Ability
Mathematics was an essential symbol language that should be learned by every high school. Basic thinking skills in learning mathematics are usually formed through activities (Mursalin et al., 2018). Communication skill can improve by activities in learning mathematics. The student who learned mathematics should possess communication ability by using mathematical symbols (Qohar & Sumarmo, 2013). Communication is a procedure, which consists such part as communication, interaction and perception (Anatolievna, Munirovna, Kasimovna, Mirzayanovna, & Anatolievna, 2017). Communication is the most critical element of the all personality development system. A person observes another person's "inner world" in the communication cycle. However, this process needs a specific "inner world" of a participant. Thus, communication is a specific information intercourse, the cycle of sending emotional and intellectual information to the recipient of the message. The person, whose purpose is to have some influence on the recipient, sends a specific message. The message may be encoded using verbal (words) and nonverbal (body language, mime, gestures, intonation, symbols, etc.) signs. The recipient must think to understand the message. As a result, a specific communication cycle loads successive moves of the partners. Communication intercourse can be shown in a statement, question or inducement, concealing or demonstrating motives. Communication always has a specific situational character which is determined by the relations between the participants (Shaidullina et al., 2015). In mathematics, communication plays an important role (Tinungki, 2015). Communication becomes an important element of learning mathematics. Communication is the attempt to show message, idea, or anything news from the communicator to the communicant and vice versa. Communication plays crucial part in the learning cycle, including mathematics learning

METHODOLOGY

In this research, the researcher describes the student's ability in communicating mathematical idea on lecturing teaching strategy. Students communicated the idea of mathematical ideas during lectures such as during practice teaching, presentation, questioning, answering lecturers' questions and when they provide arguments about a matter related to the domain of mathematics. Otherwise, these data are analyzed inductively. In this study, researchers act as the essential instrument that is as planner, executor, data collector, manager and data analyzer, conclusion

drawer and conclusion. This research was conducted in Mathematics Education Study Program in 2015/2016 semester. Descriptive method used in this study aims to describe or describe how the ability of students in communicating mathematical ideas that they have. Subjects in this study are students of the third semester of mathematics education. The sampling technique used in this research is random sampling, which is one class randomly taken from 4 existing classes, where many sample members are 10 students. Data collection techniques used in this study are observation and interview. Observations are made when students present their work. Students practice to teach.

RESULTS
The results showed various ways students communicate their mathematical ideas. Baroody (1993) put forward some aspects of communication called.
(1) Representation (representing), making representations means changing to other forms of ideas or problems, suppose a table form is represented in the form of a diagram or vice versa. Based on the observations at the time of lectures students have been able to form a chart that contains a concept map of a material. They communicate the mathematical idea they have in the form of a chart containing a concept map of the set. They create a chart of the content of the set that includes how to declare the set, the set type, the relationship between the set and the set operation.
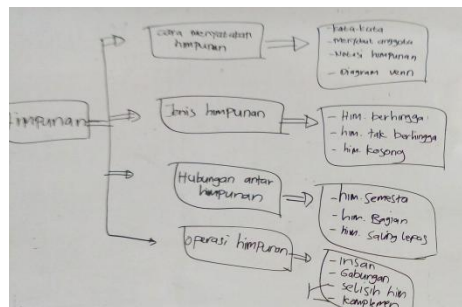

Figure 1 Chart which have made by student

2) Discussion (discussion), in the discussion students can express and reflect on his thoughts related to the material being studied. Students discuss together to discuss about the application of bruner theory at the enactive, iconic and symbolic stage. At the energetic stage students calculate the area of the classroom based on the number of ceramics in the classroom. In the iconic stage they calculate the area of the existing rectangle in the plotted image. At the symbolic stage they can write that the area of the rectangle = p x l
 (5) Writing,
Writing is a conscious activity to express and showed their thinking, which are poured in the media, whether paper, computer or other media. Writing is a useful tool of thinking because students gain math experience as a creative activity. Students write the formula and make examples about the opportunity. Student wrote the formula about probability. They wrote $P(A) = \frac{nA}{nS}$ and they wrote about set symbol in sample space, $S = \{1,2,3,4,5,6\}$
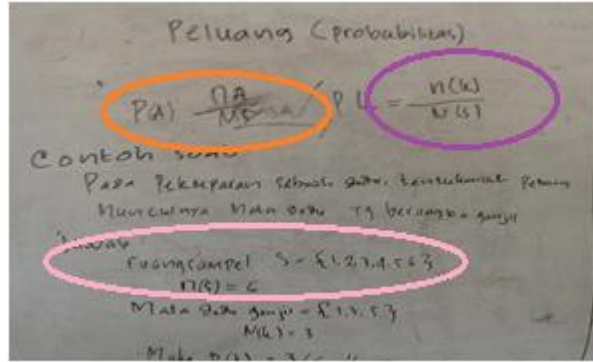
Figure 2 The Results of Student Writing on the Board

Students do less precise writing mathematically. The wording of "elements" is abbreviated by an unknown symbol in mathematics. Writing "coefficients they write" coovisien.
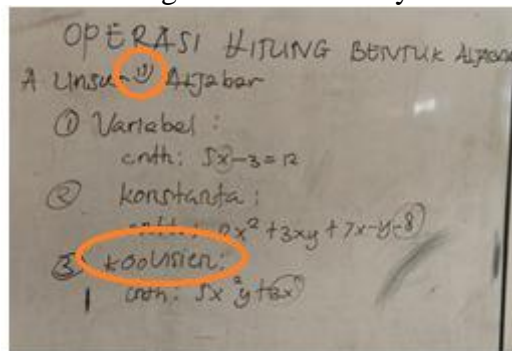

Figure.. The Results of Student Writing on the Board

Various student behaviors were shown during field observations. There was student who wrote with their left hand. He could write on board fluently. He solved the problem below.

Figure Student wrote using left hand

He solved the problem about arrange number. Mathematical understanding is needed by students in solving math problems (Damayanti & Mayangsari, 2017). The problem which was solved was taken from Musser (2006). The problem was showed below.

In the following **cryptarithm**—that is, a collection of words where the letters represent numbers—*sun* and *fun* represent two three-digit numbers, and *swim* is their four-digit sum. Using all of the digits 0, 1, 2, 3, 6, 7, and 9 in place of the letters where no letter represents two different digits, determine the value of each letter.

$$
\begin{array}{r}
\text{sun} \\
+\ \text{fun} \\
\hline
\text{swim}
\end{array}
$$

Figure Problem which is solved by student

He solved the problem with trial and error ways. He tried to substitute the number and check it. So he could found the solution which $= 4 ; m = 8 ; u = 4; i = 8; w = 0; s = 2; f = 8$
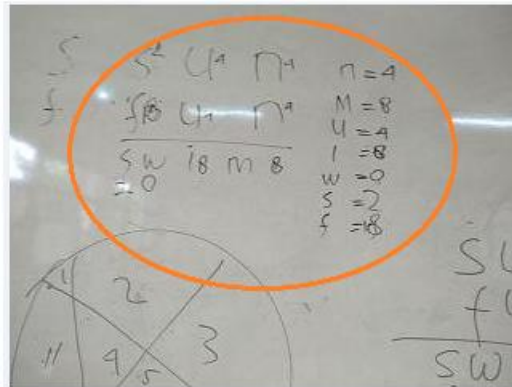

Figure Problem which is solved by student

DISCUSSION

Writing in mathematics class is an excellent way to develop communication skills. One way is to ask students to write their answer along with two or three cases why they know their answer is right. Another way is to create a learning log in which students record what they learned each day in their own words. These types of activities encourage both reflection and metacognition, our understanding of how we learn. Writing also promotes student learning in mathematics because it helps students internalize what they are learning and develop self-confidence in their ability to do mathematics. Chapin and O'Connor (2007) suggest five specific strategies for using classroom talk learning mathematics

1. Restate a student's statement and then ask the student whether the restatement is entirely accurate. This helps students clarify their thinking.
2. Ask students to repeat what another student has just said. This strategy broadens the discussion by including more students and also motivates students to pay attention so that they can answer correctly if they are called on.
3. Ask questions. This encourages students to use reasoning to evaluate other students' statements and analyze other students' mistakes.
4. Ask simple questions. Pose questions. This elicits comments from students who had not previously contributed.
5. Increase wait time. Wait time is the time a teacher waits after asking a question before calling on students. Often, teachers become uncomfortable after about three seconds of silence and either call on someone before students have a chance to volunteer, call on a different student than the one to whom the question was initially addressed, or give the answer themselves. Three seconds is not enough time for students to think about an issue and compose a reply.

CONCLUSIONS

The conclusion of this research is student communication ability in expressing mathematical idea which grouped based on communication aspect is as follows
1) Aspects of Representation (representing)
 Students have been able to form a chart containing a concept map of a material. They communicate the mathematical idea they have in the form of a chart containing a concept map of

the set. They create a chart of the content of the set that includes how to declare the set, the set type, the relationship between the set and the set operation.

(2) Hearing (listening)

Students express their mathematical ideas based on guidance delivered by lecturers. They responded to the lecturer's explanation. Suppose that when lecturers convey material about the theory of mathematics learning, they suggest that they once knew a teacher applied the theory of learning but when interviewed the teacher is not yet know which expert learning theory is being used.

(3) Reading (reading)

When the presentation of a student who is not a presenter reads and listens to what his or her peers are presenting, they then recall in their language what they have understood based on reading and listening to their peers' presentations. 75% of students have been able to express their mathematical ideas based on the results of reading and listening to presentations. They reveal that the theory of learning behavioristic flow does not pay attention to the stage of mental development of humans. Behavioristic behavioral learning theory works based on the stimulus that generates a response

4) Discussion (Discussing)

Students discuss together to discuss about the application of bruner theory at the enactive, iconic and symbolic stage. At the energetic stage students calculate the area of the classroom based on the number of ceramics in the classroom. In the iconic stage they calculate the area of the existing rectangle in the plotted image. At the symbolic stage they can write that the area of the rectangle = p x l

 (5) Aspects of Writing (writing)

Students have been able to write down the formula and create sample questions about the opportunity

ACKNOWLEDGEMENTS

REFERENCES

Anatolievna, S. T., Munirovna, N. A., Kasimovna, V. D., Mirzayanovna, S. L., & Anatolievna, B. T. (2017). Pedagogical Management of University Students ' Communication Ability Development. *International Journal of Instruction*, *10*(3), 79–92. https://doi.org/10.12973/iji.2017.1036a

Australian Education Council.(1991) *A National Statement on Mathematics for Australian Schools.* Curriculum Corporation, Carlton, Victoria.

Baroody, A.J.(1993) *Problem Solving, Reasoning, And Communicating, K-8 Helping Children Think Mathematically.* New York: Macmillan Publishing Company

Chapin, S. H., and C. O'Connor. (2007)."Academically productive talk: Supporting students' learning in mathematics." In *The Learning of Mathematics: Sixty-Ninth Yearbook,* ed. W. G. Martin and M. E. Strutchens, pp. 113–128. Reston, VA: NCTM.

Damayanti, N. W., & Mayangsari, S. N. (2017). Analisis kesalahan siswa dalam pemahaman konsep operasi hitung pada pecahan, *4*(1), 1–7.

Ernest, Paul. (1991) *The Philosophy of Mathematics Education.* Bristol, PA, USA The Falmer Press

Hunsader dkk.(2014) *Assessment accompanying published to which mathematical processess are evident* .ZDM Mathematics Education

Mursalin, M., Nuraini, N. L. S., Purnomo, H., Damayanti, N. W., Kristanti, D., Rohim, A., … Muliana, M. (2018). The development of algebra teaching materials to foster students' creative thinking skills in higher education. *Journal of Physics: Conference Series*, *1088*. https://doi.org/10.1088/1742-6596/1088/1/012101

NCTM. (2000). *Principles and standarts for school mathematics*. Reston VA: The National Council of Teachers of Mathematics, Inc.

Nillson and Ryve.(2010). *Focal contextualization in effective communication in the mathematics classroom*. Educ Stud Math

Qohar, A., & Sumarmo, U. (2013). Improving Mathematical Communication Ability and Self Regulation Learning Of Yunior High Students by Using Reciprocal Teaching. *IndoMS.Journal on Mathematics Education*, *4*(1), 59–74.

Shaidullina, AR, Maksimova, OG, Fadeeva, EY, Khairullina, ER, Valeyeva, NS, Zaripov, RN, Zaripova, IR & Kuzmin, NV (2015). Development dynamics study of professional and pedagogical culture of communication in professional activities of teachers. *Mediterranean Journal of Social Sciences*. 6,(2), 216-225.

Shield, M., & Galbraith, P. (1998). The analysis of student expository writing in mathematics. *Educational Studies in Mathematics, 36*, 29-52.

Tinungki, G. (2015). The Role of Cooperative Learning Type Team Assisted Individualization to Improve the Students' Mathematics Communication Ability in the Subject of. *Eric*, *6*(32), 27–31. Retrieved from http://files.eric.ed.gov/fulltext/EJ1083611.pdf