International Journal of Instruction *July 2020 ● Vol.13, No.3*
e-ISSN: 1308-1470 ● www.e-iji.net *p-ISSN: 1694-609X*
pp. 729-744

Received: 01/03/2019
Revision: 27/02/2020
Accepted: 05/03/2020
OnlineFirst:19/05/2020

Comparison between Generative Learning and Discovery Learning in Improving Written Mathematical Communication Ability

Wardono
Mathematics Education Study Program of Universitas Negeri Semarang, Indonesia, *wardono@mail.unnes.ac.id, wardono_unnes@yahoo.com*

Rochmad
Mathematics Education Study Program of Universitas Negeri Semarang, Indonesia, *rachmad_manden@yahoo.com*

Khasanah Uswatun
Mathematics Education Study Program of Universitas Negeri Semarang, Indonesia, *nanauswatunkh@gmail.com*

Scolastika Mariani
Mathematics Education Study Program of Universitas Negeri Semarang, Indonesia, *scmariani.unnes@gmail.com*

This study aims to examine the improvement of students' written mathematical communication ability in generative learning assisted by teaching aids and discovery learning and describe students' written mathematical communication in terms of self-confidence. The method used in this study is mix-methods. The population in this study were seventh-grade students of Godong Junior High School 1 in the academic year 2018/2019 as many as 5 classes, and samples were selected by cluster purposive sampling technique as much as two classes for the experimental group and the control group. Data collection methods include tests, questionnaires, documentation, and interviews. The results of this study are improving students' written mathematical communication ability with the application of generative learning assisted by teaching aids better than implementing discovery learning. Description of students' mathematical written communication ability with high confidence able to meet all indicators of communication ability written mathematically, with medium confidence is being able to meet several indicators of mathematical written communication ability while low self-confidence can only fulfill the first indicator of mathematical written communication ability.

Keywords: mathematical, communication, self, confidence, generative, learning

Citation: Wardono, Rochmad, Uswatun, K., & Mariani, S. (2020). Comparison between Generative Learning and Discovery Learning in Improving Written Mathematical Communication Ability. *International Journal of Instruction*, 13(3), 729-744. https://doi.org/10.29333/iji.2020.13349a

INTRODUCTION

Education is an important aspect of life. Education is an effort in the process of developing human resources. This is following Law No. 20 of 2003 concerning the National Education System that national education functions to develop capabilities to educate the life of the nation. The quality of education is one of the determinants of the quality of human resources. The effort to improve the quality of education is expected to create a generation of good quality so that the nation's life becomes better.

According to the regulation of Minister of Education and Culture No. 58 of 2014 concerning Junior High School Curriculum 2013, mathematics is a universal science that is useful for human life and also underlies the development of modern technology, and has an important role in various disciplines and advancing human thinking. Mathematics subjects need to be given to all students starting from elementary school to equip students with the ability to think logically, analytically, systematically, critically, innovatively, and creatively, as well as the ability to cooperate. Thus, it can be said that mathematics is a science that has important values in education.

According to Wardono & Mariani (2015) that the quality of education in Indonesia is still low compared to other countries, especially in the field of mathematics as shown in the following data: (1) The Trends in International Mathematics and Science (TIMSS) Survey puts Indonesia in 34 of 45 countries; (2) The Program International Student Assessment (PISA) in mathematics places Indonesia in 39 out of 40 countries in 2003, in 38 of 41 countries in 2006, and 61 of 65 countries in 2009. In 2015, Indonesia was still ranked 56 of the 65 countries participating in PISA are in calculating, reading and science ability (OECD, 2015). The results of the United Nation Development Program 2014(UNDP, 2014) on the ranking of the Human Development Index (HDI as quoted in Winardi state that Indonesia ranks 110 out of 187 countries in the world (Winardi, 2018). While the results of the Trends in the International Mathematics and Science Study (TIMSS) study show Indonesian students are in very low rankings inability (1) understand complex information, (2) theory, analysis, and problem-solving, (3) use of tools, procedures and solutions problem, (4) conducting an investigation (Ministry of National Education, 2013). The low results of these international studies indicate that especially in reading comprehension ability the competence of Indonesian students is low.

Wardono & Kurniasih (2015) revealed that the ability to study, reason, communicate, solve and interpret problems in various situations in Indonesian students is still relatively low. The ability to examine, reason, communicate, solve and interpret problems is part of mathematical literacy ability.

The purpose of mathematics learning according to regulation Minister of Education and Culture No. 58 of 2014 (Kemendiknas, 2014) is so that students have the following abilities: (1) understanding mathematical concepts; (2) using patterns as allegations in solving problems, and being able to generalize based on existing phenomena or data; (3) using reasoning in nature, doing mathematical manipulation both in simplification, and analyzing existing components in problem-solving in mathematical contexts and outside mathematics (real life, science, and technology); (4) communicating ideas, reasoning and being able to compile mathematical evidence using complete sentences, symbols, tables, diagrams, or other media to clarify the situation or problem; (5) having an attitude of appreciating the usefulness of mathematics in life; (6) having attitudes and behaviors that are following the values in mathematics and learning; (7) perform motoric activities that use mathematical knowledge; and (8) using simple teaching aids as well as technological results to carry out mathematical activities. According to the National Council of Teachers of Mathematics (NCTM, 2000) that the abilities students need to have through Mathematics learning is included in the standard process, namely: (1) problem solving, (2) reasoning and proof, (3) connection, (4) communication, and (5) representation. In this study, the ability to be measured is the students' mathematical communication ability.

Based on the description, there is conformity or understanding between the objectives of the mathematics subject itself and the understanding of mathematical literacy. The definition of mathematical literacy according to the draft 2012 PISA assessment framework in the (OECD,2016):

"*Mathematical literacy is individual capacity to formulate, to employ, and to interpret mathematics in various contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain and predict phenomena. It assists individuals to recognize the role of mathematics and needed by constructive, engaged and reflective decisions citizens'.*

Based on the (OECD, 2016), mathematical literacy ability consist of seven components, namely: (1) communication; (2) mathematizing; (3) representation; (4) reasoning and arguments; (5) devising strategies for solving problems; (6) using symbolic, formal, and technical language, and operations; (7) using mathematical tools.

One important component that students must master in mathematical literacy ability is communication ability. This is under the description of the *National Council of Teachers of Mathematics* (NCTM, 2000) that the abilities students need to have through Mathematics learning is included in the standard process, namely: (1) *problem solving*, (2) *reasoning and proof*, (3) *connection*, (4) *communication*, and (5) *representation*. In this study, the ability to be measured is the students' mathematical communication ability.

Clark (2005) explains how important it is to have communication ability mathematically because mathematical communication is a way and understanding so that through communication ideas can be developed through a process to build meaning and explain the idea. Communication is fundamental in mathematics because it is a way for students to present mathematical ideas or ideas verbally or in writing (NCTM, 2000). When students communicate the ideas of their thoughts verbally or in writing, the ideas will be more convincing and clear to themselves and provide opportunities for other students to listen and develop their thoughts from the information obtained. In this study, the mathematical communication ability used was written mathematical communication ability.

The 2016/2017 Godong Junior High School 1 National Examination results from data show that the average national exam results in mathematics subjects are 41.59, the average Indonesian subject is 70.57, the average English subject is 44.44, and the average science subject is 47.84. This shows that student learning outcomes in mathematics subjects are lower than the learning outcomes of other subjects, especially in aspects of students' mathematical communication ability are still not optimal. This is following the results of interviews with 7th-grade mathematics teachers at Godong Junior Hihg School 1 January 26, 2018, obtained information that there were still students who could not write down what was known and what was asked of a problem. Some students have difficulty expressing a problem in mathematical symbols or other visual forms so that sometimes they still make mistakes in determining what concepts should be used to solve the problem. Only a few students who are classified as smart can work on the problem with steps that are systematic and correct and able to provide reasons for each step of the process. Then, there are still students who cannot write conclusions about the answer to the problem. Thus, it can be said that students' mathematical communication ability is still lacking.

Important aspects besides the cognitive domain are affective aspects, one of which is student confidence. As contained in the Minister of Education and Culture Regulation No. 68 of 2013, among others: (1) shows a logical, critical, analytical attitude, is consistent and thorough, responsible, responsive, and does not easily give up in solving problems, (2) has a desire know, confidence, and interest in mathematics and have a sense of trust in the power and usefulness of mathematics, which is formed through learning experience, (3) have an open, polite, objective attitude, respect the opinions and works of friends in group interactions and daily activities. Based on the Permendikbud document, there are several competencies related to the affective aspects that students are expected to have after learning mathematics, including students' self-confidence.

Each student has different self-confidence so that it affects the results of mathematical abilities. Thus, the mathematical and self-confidence abilities of students in mathematics learning are influential to facilitate students in finding solutions to a mathematical problem.

Therefore, one effort to improve mathematical communication ability in terms of the confidence that students have is the accuracy of using learning models that are appropriate to the material and conditions of students in the class. According to Rochmad (2012) in the implementation of learning in schools, the indicator to state that the implementation of this learning model is said to be "good" is to see whether the components of the model can be implemented by the teacher in the field in classroom learning and whether students can take part in learning. According to Hidayah & Sugiarto (2015) the effectiveness of the model is indicated by suitability and goals or targets and the results of the implementation of the model. Anintya (2017) also revealed that the selection of appropriate learning models can also affect the quality of student learning.

Learning that is expected to be able to develop students' ability to communicate mathematically and confidently is learning that involves many students in the process, one of which is the generative learning model. The results of Isnaeni & Maya's (2014) study show that generative learning can improve students' communication and self-confidence. (Anderman, 2010) revealed that generative learning contains three main components of the motivational theory which include (a) the role of cognition in research motivation, (b) building meaning and motivation, and (c) beliefs about abilities. Generative learning models show that learning is enhanced when individuals are asked to produce their cognitions that are generated based on their prior knowledge. Each stage contained in the generative learning model is expected to make students active learning in constructing their knowledge so that the ability to express ideas in written, oral and visual forms can be trained.

The generative learning model was first introduced by Osborne and Cosgrove. According to Osborne and Wittroc, as quoted by Hamdani et al. (2012), Generative learning is a learning model where students actively participate in the learning process and in constructing the meaning of the information around it based on their initial knowledge and experience. According to (Utami, 2015) that generative learning has 5 stages, namely the orientation stage, the idea disclosure stage, the challenge and restructuring stage, the implementation stage, and the look backstage.

According to (Fiorella & Mayer, 2015), the stages in generative learning aim to motivate students to actively understand the information they learn during learning by selecting the most relevant information, organizing it into a coherent mental representation, and integrating it with their existing knowledge. To improve mathematical communication ability, students are allowed to express their ideas or ideas with various variations, such as drawing, writing or mathematical models Osborne & Wittrock in (Hutapea, 2013). Based on the results of (Utami, 2015) and (Hutapea, 2013) research, Generative learning is effective for improving students' mathematical communication ability.

The use of teaching aids can help students increase the abstraction power of students so that they are expected to be better able to master the concepts in fraction material. Props are learning media that are used to help embed concepts or develop abstract concepts, so students can grasp the true meaning of the concept (Suharjana, 2009). Brunner revealed that in the learning process, children should be allowed to manipulate objects (props) so that children can understand the concept well.

The following are the stages of generative learning assisted by teaching aids used in this study. Stage *orientation*, at this stage the teacher carries out the initial activities of learning which are to provide activities through demonstrations that can stimulate students to orient their knowledge, ideas or initial conception obtained from daily experience or obtained from learning at the previous class level, thus encouraging students to express opinions /idea. Stage of *disclosure of ideas*, teachers classify students heterogeneously consisting of 4-5 students per group and distribute students worksheets as a discussion to be discussed in groups. Students are allowed to bring up ideas, at this stage students realize there are differences of opinion among students regarding the subject matter. The stage *challenge,* students use props to find concepts, listen and express opinions or ideas during discussions, observe props and see teachers explain material visually, and solve problems in groups. Students with guidance begin to understand and solve problems in mathematical communication. The phase *implementation*, the purpose of this stage is to help students apply their new knowledge or ability to the work so that learning outcomes will stick and the results of the results will continue to increase. At this stage, students deepen their knowledge through the presentation of the results of discussions from each group. Phase *looking back*, students apply and expand their knowledge or new ability in exercises so that the learning outcomes will be attached and the appearance of the results will continue to rise.

Based on this background, the problems that have been examined in this study are (1) is the average mathematical written communication ability of 7^{th}-grade students of Godong Junior High School 1 with the application of generative learning assisted by teaching aids able to achieve a minimum of 70?, (2) whether the completeness proportion of mathematical written communication ability of 7^{th}-grade students of Godong Junior High School 1 with the application of generative learning assisted by teaching aids is better than the proportion of mathematical communication ability of 7^{th}-grade students of Godong Junior High School 1 by implementing discovery learning?, (3) whether the increase in mathematical written communication ability of 7^{th}-grade students of SMPN 1 Godong with the application of generative learning assisted by teaching aids is better than the increase in mathematical written communication abilities of 7^{th}-grade students of SMPN 1 Godong with the application of discovery learning?, (4) how is the description of mathematical written communication ability of 7^{th}-grade students of Godong Junior High School 1 with the application of generative learning assisted by teaching aids in terms of self-confidence.

METHOD

This study is a mixed-methods model concurrent embedded. The type of research used in this study is experimental research with the control group pretest-posttest designs.

The population of this study was all seventh-grade students of Godong Junior High School 1 in the academic year 2018/2019. In this study, sampling with cluster random sampling technique randomly selected two classes as the study sample, namely the experimental group 40 persons given generative learning assisted by teaching aids and the control group 40 persons were given learning with discovery learning. The selection of research subjects based on purposive sampling. In this case, students' self-confidence is categorized based on questionnaire scores into 3 categories: high self-confidence, moderate self-confidence, and low self-confidence. The categorization of self-confidence is based on categorization according to Azwar (2012, p. 149). The subjects chosen for the analysis of mathematical communication ability were 6 students with each category of self-confidence selected by 2 students.

The test technique is used to obtain data about students' mathematical communication abilities. The questionnaire technique is used to identify the level of confidence students have. The interview technique is used to obtain information about mathematical written communication ability in terms of student confidence selected based on each category that has been grouped in the experimental group.

The researcher has done its analysis of test the initial ability of mathematical written communication test data includes the normality test, homogeneity test, and average similarity test. The results analysis of item test questions mathematical written communication ability with reliability coefficient 0.54, validity coefficient 0.403-0.797, the item's different power is significantly coefficient 0.209-0.609, and level of difficulty normal (2 easy questions, 6 moderate questions, and 2 difficult questions). Analysis of test data of students' written mathematical communication ability include normality test, homogeneity test, average test, the similarity of proportions test, gain normalized test, and average difference test.

To find out students' self-confidence, the questionnaire scores that have been filled out are used. The questionnaire scores are then sorted by the lowest score to the highest score. Furthermore, after determined the number of scores obtained in filling out the questionnaire, an interpretation of the results of the students' self-confidence questionnaire was carried out by observing the norms of categorization (Azwar, 2015) as shown in Figure 1 below.

Interval Score Questionnaire	Category Self-Confident
$x \geq (\mu + \sigma)$	High
$(\mu - \sigma) \leq x < (\mu + \sigma)$	Medium
$x < (\mu - \sigma)$	Low

Figure 1
Interpretation Measurement Result Questionnaire
Description:

μ : mean

σ : standard deviation

x : score student’s self-confidence questionnaire

FINDINGS AND DISCUSSION

Based on the data analysis of the (seventh grade) semester quiz test for the academic year 2018/2019 shows that the sample comes from a population that is normally distributed and has the same variance (homogeneous). The average similarity test results obtained that there were no significant differences in mean. This shows that the experimental class and the control class come from the same conditions. The study was conducted in six meetings. Learning takes place for four meetings, one meeting for the *pretest* in the experimental class and the control class, and one meeting for the *posttest*. The study began with the filling of self-confidence questionnaires and pretest mathematical communication ability consisting of 5 item description questions given to the experimental class and the control class. Then the study continued with the implementation of learning in the experimental class and control class with number material and ended with the implementation of posttest mathematical communication ability consisting of 5 items of the description given to the experiment class and the control class.

Completeness of Students' Written Mathematical Communication Ability

This hypothesis test uses a one-party average test. The average test of one party to determine whether the average mathematical written communication ability of class VII students with Generative learning assisted by teaching aids reaches a minimum criterion of completeness of 70 statistically. From the results of the test calculation *t*, the value of

obtained t_{count} = 4.45 and t_{table} = 1.68. Obviously t_{count} = 4.45 > 1.68 = t_{table}, so H_0 is rejected, it means that the average written mathematical communication ability of students who follow Generative learning assisted by teaching aids have reached the minimum completeness criteria of 70.

This is in line with the results of Utami (2015) which states that students' mathematical communication ability in the generative model with group investigation strategies achieve average completeness of at least 75. One factor is generative learning syntax which requires students to actively discuss in groups. Students exchange ideas and discuss to find solutions to problems given and gain new knowledge from their group friends. Group discussions also increase students' confidence in expressing ideas that are in their minds because students feel comfortable channeling ideas with their peers. (Slavin, 1980) has argued that, for academic achievement, cooperative learning techniques are no worse than traditional techniques, and in most cases, they are significantly better. For low-level learning outcomes, such as knowledge, calculation, and application of principles, cooperative learning techniques appear to be more effective than traditional techniques. For high-level cognitive learning outcomes, cooperative techniques that involve high student autonomy and participation in decision-making may be more effective than traditional individualistic techniques, it means learning with friends or group learning can make students remember what has been learned better than students who only learn by themselves. In generative learning assisted by teaching aids, students use props to find concepts from mathematical abstract objects so that students get new and enjoyable learning experiences.

The Proportion of Completeness of Written Mathematical Communication Ability

This hypothesis test uses a proportional similarity test to find out whether the completeness proportion of students 'mathematical written communication ability with generative learning assisted by teaching aids is better than the proportion of completeness of students' written mathematical communication ability with discovery learning. then a similarity test is carried out. Based on the calculation obtained z_{count} =

1.68 and z_{table} = 1.64. Because $z_{count} = 1.68 > 1.64 = z_{table}$, then H_0 is rejected, meaning the proportion of completeness of students 'written mathematical communication ability with generative learning assisted by teaching aids is better than the proportion of completeness of students' written mathematical communication ability with discovery learning. The completeness proportion of students 'test scores in the experimental group was 87.5%, while the completeness proportion of students' test scores in the control group was 72.5%.

That means the ability of students 'written mathematical communication with generative learning assisted by teaching aids is better than students' written mathematical communication ability through discovery learning. This is in line with Sugandi (2017) who states that the effects of learning using the generative approach are better than conventional learning. In generative learning assisted by teaching aids, students are directed to master mathematical concepts with the help of teaching aids through various stages, including orientation stages, idea disclosure stages, challenges and restructuring stages, implementation stages and revisiting stages. According to Hamdani et al. (2012) that by utilizing teaching aids in the learning process can generate new desires and interests, and can motivate and stimulate student learning, it can even bring psychological influence to students. This is consistent with Wena's (2009) statement that the advantages of generative learning are generative learning can improve student learning activities and concepts learned by students will enter long-term memory students stimulate students' curiosity so that they construct or build their own understanding in the teaching and learning process.

Written Mathematical Communication Ability Enhancement

To find out whether the improvement of students 'written mathematical communication ability with generative learning assisted by teaching aids is better than increasing students' written mathematical communication ability with discovery learning statistically. This improvement test using the formula gain then tested the difference in average increase. Test of difference in average improvement in this study using the t-test. The data used is the gain value of the experimental class and the gain value of the control class. From the results of the test calculation *t*, the value of obtained $t_{count} = 3.11$ and $t_{table} = 1.66$. Obviously $t_{count} = 3.11 > 1.66 = t_{table}$, so H_0 is rejected. That is, the improvement of students 'written mathematical communication ability with generative learning assisted by teaching aids is more than an increase in students' written mathematical communication ability with discovery learning.

Based on the analysis, some things cause an increase in the results of mathematical written communication ability between students learning with generative learning assisted by teaching aids higher than students who learn discovery learning, namely different learning processes or the learning syntax of the applied model.

According to Wittrock (Lee, 2008), generative learning is a learning model where students do not passively receive information. They build a meaningful understanding of the information found in the environment. According to Osborno and Wittrock (in Rahayu et al., 2018), generative learning emphasizes the active integration of new knowledge by using knowledge already mastered by students. New knowledge will be tested for use in answering questions and stored in long-term memory. This is consistent with several studies that show that generative learning influences and enhances cognition. That there are differences in creative thinking and scientific processability and increasing mathematical understanding ability among students in generative learning.

This means an increase in students 'mathematical written communication ability with generative learning assisted by props is higher than increasing students' written mathematical communication ability through discovery learning. The results of Hulukati (2005), Rafiq & Gida (2012), Hutapea (2013) show an increase in mathematical communication ability taught with Generative learning models better than increasing students' mathematical communication ability taught with conventional models both based on overall students and levels students. The results of this study are also following the characteristics of generative learning proposed by Wittrock as quoted by Ikhsan & Rizal (2014) which states that in generative learning, students `'communication ability will experience improvement as a result of students' efforts to combine new knowledge with prior knowledge. So generative learning has a positive relationship with mathematical communication ability.

To find out a clearer picture of improving written mathematical communication ability, in this section we will describe the achievement and improvement of mathematical written communication ability according to indicators. Indicators of students' mathematical communication ability assessed in this study are mathematical written communication ability, namely: (1) the ability to write what is known and asked of a problem, (2) the ability to express problems with mathematical symbols or other visual forms in presenting ideas the idea of mathematics in writing, (3) the ability to write steps for solving problems systematically and correctly and provide reasons for the steps in the process, and (4) the ability to write conclusions on the answers to problems according to the questions. The achievement diagram of written mathematical communication according to indicators is as follows.

Based on figure 2 of increasing mathematical written communication ability below, it can be seen that for the 1st, 2nd, 3rd, and 4th indicators, students in the experimental class who have generative learning assisted by teaching aids get a higher increase than students in control class that has discovery learning. Overall, an increase in mathematical written communication ability for students with generative learning assisted by props is higher than students with discovery learning.

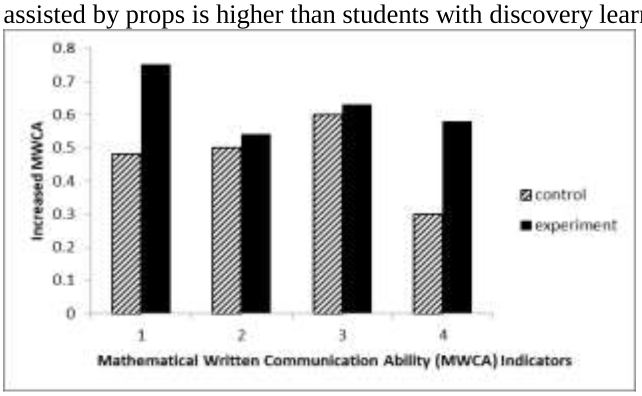

Figure 2
Increased by 4 Indicators Written Mathematical Communication Ability between Experiment Class and Control Class

Analysis of Confidence Questionnaire Data

Based on the results of the self-confidence questionnaire analysis of 40 students of VII D class Godong Junior High School 1, there were 5 students with low self-confidence categories, 30 students with moderate self-confidence categories, and 5 students with high self-confidence categories. This is in line with Nurdiana's research (Nurdiana, 2018), that students with self-confidence moderate are more dominant than students with high self-confidence and students with self-confidence low. After that, 2 research subjects were selected from each category of student confidence as shown in Table 1 below.

Based on the analysis of students' mathematical communication ability, it is found that students with confidence in each category have different mathematical communication abilities, namely in the category of high self-confidence, medium self-confidence, and low self-confidence. This is following the results of research by Ambarwati (Ambarwati et al., 2015) shows that the difference confidence that students have cause differences in students' mathematical communication ability.

Table 1
Self Confidence in Research Subjects

Self-Confident Categories	Subjects
High Self-Confidence	S12
	S37
Medium Self-Confidence	S15
	S24
Low Self-Confidence	S4
	S23

Description of Written Mathematical Communication Ability Based Students' Self-Confidence

Written mathematical communication ability of students with high self-confidence

S12 and S37 are students in the high confidence category. Based on the results of the scan-test, observation, subject interview, close friend interview of the subject, and teacher interview, the students in the high confidence category have excellent mathematical communication abilities compared to their peers. So that in observing mathematical written communication indicators which consist of writing down what is known and what is asked of a problem; state problems with mathematical symbols or geometric shapes, tables, diagrams or graphs; write down the steps for solving problems systematically and correctly; write the conclusions of the answers to the problems according to the questions in the high confidence category students meet the indicators in the good to very good range.

At the beginning of the learning, indicators write steps to solve the problem systematically and correctly and write the conclusions of the answers to the problem following the questions are not optimal, through the generative learning process assisted by teaching aids, there are developments in the indicators systematically write down the problem-solving steps and write conclusions. So that it can be seen in the final test results that the students in the high self-confidence group experienced an increase in the problem-solving process and made written conclusions appear to have answered the questions correctly so that the indicators write systematically the steps to solve the problem and the indicators write conclusions.

It can be stated that students with high self-confidence can achieve all indicators of mathematical written communication to the maximum. This is in line with the results of research from Jahani and Behzadi (in Jahani & Behzadi, 2014) which concluded that there was a strong relationship between confidence and mathematical abilities. So that the higher a person's confidence, then the students' mathematical abilities will also increase. According to Bandura, as quoted by Sefiany (Sefiany et al., 2016) that individuals with high self-confidence can quickly restore their confidence when they experience failure and have high aspirations and commitments on the task.

Written mathematical communication ability of students with medium self-confidence

Subjects S15 and S24 are students who belong to the category of medium self-confidence. Based on the results of scan-tests, observations, subject interviews, interviews with close friends of subjects, and teacher interviews, students in the self-confident category were having good mathematical written communication ability. The indicator of the ability to write down what is known and what is asked of a problem is good, it has already been seen starting from the initial test. Indicator of ability states problems with mathematical symbols or geometric shapes, tables, diagrams or graphs; write down the steps for solving problems systematically and correctly, and writing the conclusion of the answer still looks bad on the initial test. Then through classroom observations, researchers see the development of these three indicators. The analysis of the researchers was also strengthened by the results of the final test and interviews with students in the medium self-confidence category. The three indicators that were initially lacking have improved well even though the indicators wrote systematic steps to solve the problem still needed a long time to solve complex problems.

This is following the results of a study conducted by Tresnawati, Hidayat & Rohaeti (in Tresnawati et al., 2017) who argued that students with less self-confidence in mathematics would tend to work on problem-solving following procedures and rely more on memorization so that students become weak in decision making during the process of resolving the problems they experienced. This is also consistent with the Permata study (in Permata, 2015) which states that the barriers of students who have sufficient mathematical communication are the ability to read, write, and understand mathematics.

Written mathematical communication ability of students with low self-confidence

S4 and S23 are students in the low self-confidence category. Based on the results of the *scan-test,* observation, subject interview, close friend interview of the subject, and teacher interviews, the low self-confidence category students had sufficient mathematical written communication ability. The initial conditions of students' mathematical written communication ability in the lower group if viewed from four indicators of mathematical written communication ability are still classified as low. But when learning takes place, the students' mathematical written communication ability in the low self-confidence category has increased.

The increase occurs in the four indicators of communication ability, although the increase is not so significant that it is still classified as sufficient. Indicators write down what is known and what is asked of a problem is good but still conditional. While the other three indicators are still in the less category. So students with low self-confidence categories still cannot maximize their written mathematical communication ability. This is following the results of research from Hendriana (in Hendriana, 2014), which revealed that someone who does not have full confidence will only achieve less than what he should be able to solve.

CONCLUSION

Based on the results and discussion, conclusions are obtained as follows.

1. The average mathematical written communication ability of students with generative learning assisted by teaching aids reaches minimum completeness of 70

2. The proportion of completeness of students 'written mathematical communication ability with generative learning assisted by teaching aids is better than the proportion of completeness of students' written mathematical communication ability with discovery learning.

3. Increasing the ability of mathematical written communication of class VII students of Godong Junior High School 1 with the application of generative learning assisted by teaching aids is better than increasing the mathematical written communication ability of class VII students of Godong Junior High School 1 with the application of discovery learning.

4. Based on the analysis of students written mathematical communication ability in terms of self-confidence, the results showed that students with high self-confidence were able to meet all the indicators of written mathematical communication ability, students with medium self-confidence were only able to communicate information from problems by writing down what they knew and what was asked, it is only enough to formulate a strategy in solving problems and the ability to conclude following what is requested in the problem. Meanwhile, students with low self-confidence are only able to meet the first indicator which is only able to communicate information from the problem by writing down what is known and what is requested in the given problem.

RECOMMENDATION

Based on the above conclusions, the following recommendation can be given.

1. Generative Learning assisted by teaching aids should be used as an alternative learning model for teachers on material that can improve the written mathematical communication ability applied in the classroom.

2. Students who have high self-confidence should be given motivation by the teacher to make it easier for them to express mathematical ideas from the form of mathematical communication.

Students who have medium self-confidence should be given motivation and opportunity by the teacher to be more confident in finding solutions to problems that involve mathematical communication ability.

REFERENCES

Ambarwati, R., Dwijanto, D., & Hendikawati, P. (2015). Keefektifan Model Project-Based Learning Berbasis GQM Terhadap kemampuan Komunikasi Matematis dan Percaya Diri Siswa Kelas VII. *Unnes Journal of Mathematics Education*, *4*(2), 180-186. https://doi.org/10.15294/ujme.v4i2.7601.

Anderman, E. M. (2010). Reflections on wittrock's generative model of learning: A motivation perspective. *Educational Psychologist*, *45*(1), 55-60. https://doi.org/10.1080/00461520903433620.

Anintya, Y. A., Pujiastuti, E., & Mashuri, M. (2017). Analisis Kemampuan Komunikasi Matematis Ditinjau dari Gaya Belajar Siswa Kelas VIII pada Model Pembelajaran Resourse Based Learning. *Unnes Journal of Mathematics Education*, *6*(1), 37-43.

Azwar, A., & Saifuddin, S. (2012). *Penyusunan Skala Psikologi*. Yogyakarta: Pustaka Pelajar.

Clark, K. K. (2005). Strategies for building mathematical communication in the middle school classroom: Modeled in professional development, implemented in the classroom. *Current Issues in Middle-Level Education*, *11*(2), 1-12.

Fiorella, L., & Mayer, R. E. (2015). Eight ways to promote generative learning. *Edu Psychology Review*, *28*(4), 717-741. https://doi.org/10.1007/s10648-015-9348-9.

Hamdani, D., Kurniati, E., & Sakti, I. (2012). Pengaruh Model Pembelajaran Generatif dengan Menggunakan Alat Peraga Terhadap Pemahaman Konsep Cahaya Kelas VIII di SMP Negeri 7 Kota Bengkulu. *EXACTA*, *10*(1), 79-88.

Hendriana, H. (2014). Membangun Kepercayaan Diri Siswa melalui Pembelajaran Matematika Humanis. *Jurnal Pengajaran MIPA*, *19*(1), 52-60. http://dx.doi.org/10.18269/jpmipa.v19i1.424.

Hidayah, I., & Sugiarto, S. (2015). Model of independent working group of teacher and its effectiveness towards the elementary school teacher’s ability in conducting mathematics learning. *Procedia – Social and Behavioral*, *214*, 43-50. https://doi.org/10.1016/j.sbspro.2015.11.591.

Hulukati, E. (2005). *Mengembangkan Kemampuan Komunikasi dan pemecahan masalah Matematika Siswa SMP melalui Model Pembelajaran Generatif* (Unpublished doctoral dissertation). Universitas Pendidikan Indonesia.

Hutapea, H. &, Nahor, M. (2013) *Peningkatan Kemampuan Penalaran, Komunikasi Matematis dan Kemandirian Belajar Siswa SMA melalui Pembelajaran Generatif* (Unpublished master thesis). Universitas Pendidikan Indonesia.

Isnaeni, I., & Maya, R. (2014). Meningkatkan Kemampuan Komunikasi dan Disposisi Matematik Siswa Sekolah Menengah Atas melalui Pembelajaran Generatif. *Jurnal Pengajaran MIPA*, *19*(2), 159-165.

Jahani, F., & Behzadi, M. H. (2014). Effect of self-believe of students on educational progress of mathematics. *Jurnal Mathematics Education Trends and Research*, *2*(1), 1-8. doi:10.5899/2014/metr-00057.

Kemendiknas. (2014). *Peraturan Menteri Pendidikan dan Kebudayaan Nomor 58 Tahun 2014, tentang Kurikulim 2013 Sekolah Menengah Pertama/Madrasah Tsanawiyah.*

Lee, H. W., Lim, K. Y., & Grabowski, B. L. (2008). Generative learning: Principles and implications for making meaning. In J. M. Spector, M. D. Merrill, J. van Merrienboer, & M. P. Driscoll (Eds.), *Handbook of Research on educational communications and technology (ICALT'06)* (pp.761-763). Springer.

Martunis (2014). Meningkatkan Kemampuan Pemahaman dan Komunikasi Matematis Siswa Sekolah Menengah Atas Melalui Model Pembelajaran Generatif. *Jurnal Didaktik Matematika*, *1*(2), 75-84. https://doi.org/10.24815/jdm.v1i2.2070.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. US: The National Council of Teachers of Mathematics.

Nurdiana, H., Pujiastuti, E., & Sugiman, S. (2018). Kemampuan Komunikasi Matematis Ditinjau dari Self-Efficacy Menggunakan Model Discovery Learning Terintegrasi Pemberian Motivasi. *Prisma, Prosiding Seminar Nasional Matematika*, *1*, 120–129.

OECD. (2015). *PISA 2015 result in focus.* Paris: OECD

OECD. (2016). *PISA 2015 result excellence and equity in education vol 1*. Paris: OECD.

Permata, C. P., & Sunarmi, K. (2015). Analisis Kemampuan Komunikasi Matematis Siswa Kelas VIII SMP pada Model Pembelajaran TSTS dengan Pendekatan Scientific. *Unnes Journal of Mathematics Education*, *4*(2), 128-133. https://doi.org/10.15294/ujme.v4i2.7452.

Rafiq, R., & Gida, G. (2012). Meningkatkan Kemampuan Pemahaman Matematik Siswa SMP melalui Metode Pembelajaran Generatif. *Prosiding Seminar Nasional Matematika dan Pendidikan Matematika*. Yogyakarta: Universitas Negeri Yogyakarta.

Rahayu, R., Masrukan, M., & Sugianto, S. (2018). Mathematics teaching using generative learning model with character building content aided by interactive learning media. *Unnes Journal of Mathematics Education Research*, *7*(2), 35-48.

Rochmad, R. (2012). Desain Model Pengembangan Perangkat Pembelajaran Matematika. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *3*(1), 59-72. https://doi.org/10.15294/kreano.v3i1.2613.

Sefiany, N., Masrukan, M., & Zaenuri, Z. (2016). Kemampuan Komunikasi Matematis Siswa Kelas VII pada Pembelajaran Matematika dengan Model Knisley Berdasarkan Self Efficacy. *Unnes Journal of Mathematics Education*, *5*(3), 227-233. https://doi.org/10.15294/ujme.v5i3.12014.

Slavin, R. E. (2008). Cooperative learning, success for all, and evidence-based reform in education. Éducation et Didactique, *2*(2), 151-159. doi:10.4000/educationdidactique.334.

Sugandi, A. I., & Bandung, S. S. (2017). Meningkatkan Kemampuan Berpikir Kreatif dan Resiliansi Matematis Siswa SMP Melalui Pendekatan Generatif. *Pengelola Jurnal Perspektif Pendidikan*, *2*(1), 60-69.

Suharjana, S., & Agus, A. (2009). *Pemanfaatan Alat Peraga Sebagai Media Pembelajaran Matematika.* Yogyakarta: Pusat Pengembangan dan Pemberdayaan Pendidik dan Tenaga Kependidikan Matematika.

Tresnawati, W., Hidayat, H., & Rohaeti, E. E. (2017). Kemampuan Berpikir Kritis Matematis dan Kepercayaan Diri Siswa SMA. *Pasundan Journal of Research in Mathematics Learning and Education*, *2*(2), 106-112.

Utami, C., & Djuniadi, D. (2015). Pembelajaran Model Generatif dengan Strategi Group Investigastion untuk Meningkatkan Kemampuan Komunikasi Matematis Siswa. *Unnes Journal of Mathematics Education Research*, *4*(1), 26-33.

Wardono, W., & Kurniasih, A. W. (2015). Peningkatan Literasi Matematika Mahasiswa Melalui Pembelajaran Inovatif Realistik E-Learning Edmodo Bermuatan Karakter Cerdas Kreatif Mandiri. *Kreano*, *Jurnal Matematika Kreatif-Inovatif*, *6*(1), 95-102. https://doi.org/10.15294/kreano.v6i1.4978.

Wardono, W., & Mariani, S. (2015). The realistic scientific humanist learning with character education to improve mathematics literacy based on PISA. *International Journal of Education and Research*, *3*(1), 349-362.

Winardi, W., Wardono, W., & Dwijanto, D. (2018). Analisis Kemampuan Literasi Matematika Melalui Model Missouri Mathematics Project dengan Pendekatan Open-Ended. In *PRISMA, Prosiding Seminar Nasional Matematika*, *1*, 162-169.