JURNAL PENDIDIKAN MATEMATIKA DAN IPA

Vol 10, No 2 (2019) h. 284-298

<http://jurnal.untan.ac.id/index.php/PMP>

IMPROVING MATHEMATICAL REPRESENTATION ABILITY THROUGH STUDENT WORKSHEETS: A CONTEXTUAL APPROACH ON RELATION AND FUNCTION DISCUSSION

Ria Nursanti

Math Teacher in SMP Negeri 12 Sungai Raya

E-mail: riaaa.1985@gmail.com

DOI: [10.26418/jpmipa.v10i2.29665](https://doi.org/10.26418/jpmipa.v10i2.29665)

Abstract

This study aims to describe the increase in the mathematical representation ability by students with the application of contextual approach assisted by Students' Worksheet (Lembar Kerja Siswa) on the topic of Relation and Function for the eighth grade students of Junior High School 3 in Batu Ampar (SMP Negeri 3). The method used is descriptive method with classroom action research (Penelitian Tindakan Kelas). The subjects were mathematics teachers and students of class VIII. Data collection techniques used are direct observation techniques with a data collection tool is the observation sheet teachers' ability to implement the learning and observation sheet student's abilities of mathematical representation. This research was conducted in 3 cycles, in which the results showed: 1) Increasing the capability of visual representation of the first cycle to the third cycle was 27.5%, 2) Increasing the ability of symbolic representation of the first cycle to the third cycle of 5%, and 3) Improving the ability of verbal representations from the first cycle to the third cycle of 37.5%.

Keywords: *Improving, representation, contextual.*

Received : 08/10/2018

Revised : 01/06/2019

Accepted : 01/07/2019

The government as the education provider in Indonesia has set the National Standards of Education at every stage. In the Republic of Indonesia Government Regulation Number 13 of 2015 it is stated that "SNP is the minimum criteria about the education system in the entire territory of the Republic of Indonesia" One of the SNPs is the Graduate Competency Standard (SKL) as stated in the Minister of Education and Culture Regulation No. 20 of 2016, as been called "Graduates 'competency standards are criteria regarding the qualifications of graduates' abilities which include attitudes, knowledge, and abilities". To achieve this standard, Core Competencies and Basic Competencies are prepared for each subject included in the current curriculum.

The Basic Competencies to achieve Core 3 Competencies (Knowledge) and 4 (Abilities) are contained in the Regulation of the Minister of Education and Culture No. 24 of 2016. Basic competencies for Relations and Functions material as contained in the regulations are: describing and stating relations and functions using various representations (words, tables, graphs, diagrams, and equations) and solving problems related to relations and functions using various representations.

In the implementation at school, there are still many obstacles faced by the teacher, including the student learning outcomes that have not yet been maximized. Followings are the results of a daily replication analysis of 20 eighth grade classes on August

24, 2015, the following data were obtained:

Table 1. Daily test results.

No	Data Variety	Score
1.	Average	56
2.	Mostly passed	8
3.	Mostly did not pass.	12
4.	Lowest score	10
5.	Highest score	95
6.	Standard Deviation	26

From Table 1, it can be seen that the average score of students is still below the passing grade (KKM) so that the level of student completeness is still low. From the students' answers, it can be seen that most students had difficulty in solving questions related to the disclosure of mathematical ideas verbally and symbolically. Verbal difficulties are encountered when students find it difficult to express their ideas in the form of words and understand the questions in the form of story problems. Meanwhile, symbolic difficulties are encountered when students find it difficult to understand the concepts of variables and mathematical symbols given.

Aside from the daily test results, according to the principal, the supervision showed that learning process in mathematics still emphasized the symbolic aspects, so that students who were lack in understanding symbolic concepts faced difficulty in learning mathematics. Teachers rarely train students to develop verbal and visual aspects while they learn. As a result, when students encountered difficulties in symbolic aspects, they found no option to solve the questions given; neither verbally nor visually.

The difficulties experienced by students whether visually, verbally or symbolically in solving mathematical problems indicate that students' mathematical representation abilities have not yet developed. Kartini (2009: 364) states that "mathematical representation is expressions of mathematical ideas (problems, statements, definitions, etc.) used to show (communicate) the results of their work in a certain way (conventional or unconventional way)) as a result of the representation of the mind". Furthermore, Kartini (2009: 366) states that representation can basically be classified into (1) visual representation (images, diagrams, graphs, or tables), (2) symbolic representations (mathematical statements / mathematical notations, numerical / algebraic symbols) and (3) verbal representation (words). Lesh, Post and Behr (in Hwang, Chen, Dung & Yang, 2007) divide representations used in mathematics education into five types, including representation of real-world objects, concrete representations, arithmetic symbol representations, oral or verbal language representations and image representations or graph.

The variety of representation forms provides wider space for students to build their knowledge. Each form of representation has advantages and disadvantages so that the combination of using forms of representation can reduce the weaknesses of each form of representation, and can be an effective tool.

As one of the alternatives that can be done by teachers in order to improve the ability of students' math-

ematical representation is to use a contextual approach. Sanjaya (2008: 109) states that contextual learning is a learning approach that emphasizes the process of full student involvement to be able to find the material being studied and connect it to real life situations so as to encourage students to be able to apply it in their lives. Through a contextual approach, it is expected that there will be an increase in students' mathematical representation abilities that lead to the achievement of learning objectives as determined. This is because one of the contextual learning objectives is the creation of fun and meaningful learning activities so that they can overcome problems and improve students' abilities in terms of mathematical representation.

Hutagaol (2013: 97) states that "Contextual learning is significantly better in improving the ability of mathematical representation of junior high students than conventional (ordinary) learning". It is expected that through the contextual approach the material presented will be easier to understand because it is related to real world situations so that students have the opportunity to learn actively, and have the awareness to use the ideas they already have to solve mathematical problems.

Based on the problems that occur and the existence of alternative problem solving, a classroom action research is conducted which aims to determine the improvement of students' mathematical representation abilities through a contextual approach assisted by students' sheet on material relations and functions for

the eighth grade students.

METHOD

In this study, researcher used descriptive method to determine the rise in students' mathematical representation ability through a contextual approach assisted by students' worksheet. This research was conducted at Batu Ampar 3 Junior High School, especially the eighth grade students, at Jalan Raya Desa Sungai Jawi, Batu Ampar District. The subjects of this study were teachers of Mathematics class in eighth grade and the eighth grade students consisting of 20 students; 11 male students and 9 female students. Material Relations and Functions is the material in this study because this material will be continued until the ninth grade namely Quadratic Function. In addition, this material is also studied in the first semester so that if the results of research show an increase, the use of contextual approach can be applied to further material.

Based on the research method, the class in which the study was carried out, a spiral model by Kemmis and Mc Taggart (in Soesatyo, Y, 2017: 166) will be used. Data collection techniques are direct observation with a data collection tool, which named as observation sheet, the ability of the teacher to carry out learning with contextual approach, and observation sheets of students' mathematical representation abilities.

The procedure in this study according to Kemmis and Mc Taggart (1988) (in Soesatyo, Y, 2017: 165) uses a self-reflection spiral system

that starts with planning (planning), actions (acting), observing, reflecting and re-planning which are the basis for a solution to the problem. At the action planning stage, researchers collaborate with one teacher collaborator to plan actions, including: 1) making Learning Implementation Plans (RPP), and 2) preparing learning facilities and infrastructure.

At the stage of implementing the action, this study was conducted in 3 cycles. Cycle I was held for 2 meetings, Cycle II and Cycle III were carried out in 3 meetings where one meeting took 2 hours or 80 minutes. Meanwhile, the observation stage was carried out during the implementation of the cycle action with the observer, Mr. Didik Cahyono, as the science teacher who has been working for two years. Observation was carried out during learning process using observation sheets that have been prepared in advance.

In the last stage, which is reflection, the researcher collaborated with one of the teachers to reflect on the actions taken during the learning process in each cycle. After knowing the strengths and weaknesses in learning, we replanned the actions, did better in the next cycle in order to fix the mistake. To find out the ability of the teacher to carry out learning with a contextual approach, the observation sheet is prepared based on the components of the contextual approach, they are; 1) Constructivism; 2) Inquiry; 3) Asking questions; 4) Learning Society; 5) Modeling; 6) Reflection; 7) equipped with indica-

Table 2. Indicator of teacher's Ability

No	Indicator
1.	Pre- Activities Greet students and list their presence Convey learning objectives Give apperception and motivation
2.	Whilst- Activities Build students' knowledge and understanding through presenting real- life problems. Providestudents with questions and answers activity to solve with the problems. Use modeling that is related with the presented material. Manage students to have a group of 4- 5 people for each. Distribute the student worksheets. Give a brief explanation about what they are going to do. Provide students enough time to finish the worksheets. Watch the group- discussion process. Guide the groups that are still in difficulty to finish the worksheets. Ask students to present the result of their discussion. Bring their opinions to a logical conclusion. Invite the students to reflect on their activity.
3.	Post- Activities Remind students about their upcoming material for the next meeting. Provide student with an individual task.

tors in each learning activity as stated in the following Table 2.

To determine the teacher's ability to carry out learning, observations are carried out during the learning process where the scores given for each indicator are based on the observation rubric with a minimum score of 1 and a maximum score of 4. To determine the students' mathematical representationability by using a contextual approach assisted by worksheet in Relations and Functions material, the indicators of the ability of mathematical representation are contained in the following Table 3.

To determine the mathematical representation ability of students in groups, observations were carried out in each group when students worked on the questions in the worksheet where the scores given for each indicator were based on the observation rubric with a minimum score of 1 and a maximum score of 4.

While the number of questions used for tests of students' mathematical representation ability in individual Cycle I have 3 questions, in Cycle II there were 6 questions, and in Cycle III there were 6 questions where the scores given for each indicator were based on the scoring rubric with

Tabel 3. Indicator of students' Mathematical representation ability achievement.

No	Indikator
1.	Visual Representation Ability To change different visual representation in the form of given diagrams, graphics, and tables. To make visual representation from a math problem. To create or make use of visual representation
2.	Symbolic Representation Ability To create symbolic representation from a similarity or given mathematical expression differently. To create symbolic representation to clarify and solve the problem To use symbolic representation to explain the concept of math. To state visual representation in the form of symbolic representation.
3.	Verbal Representation Ability To state visual representation in the form of verbal representation. To arrange a story from given representation. To arrange interpretation from another given representation. To create verbal representation in explaining the choice of answer reasonably from the given problem. To state the steps of finishing problems through verbal representation (written text).

a minimum score of 0 and maximum score 2.

The formula for calculating the average according to Sudijono (2008: 43) is as follows:

$$P = \frac{f}{N} \times 100\%$$

Information:

- P = Percentage number
N = Frequency or number of cases
f = Frequency being sought

RESULTS AND DISCUSSION

Ria Nursanti

Improving Mathematical Representation Ability through Student Worksheets: A Contextual Approach

The data obtained in this Classroom Action Research is data about students' mathematical representation ability in Relations and Functions material using assisted worksheets with contextual approach. The data was collected from each cycle of classroom action research.

Cycle I began with the planning stage where researchers together with a collaborated teacher designed learning by compiling lesson plans and preparing facilities and infrastructure related with the agreed material; on Relations. The implementation phase was divided into three activities, they were the pre- activities, whilst activities, and post- activities. In the pre-

Table 4. Teacher's ability on first cycle.

No	Activity	Average
1.	Pre- Activity	2,67
2.	Whilst Activity	2,67
3.	Post- Activity	1,25
Total Score		2,5

Table 5. The observation result on first cycle

No	Representation Ability Indicator	Average (%)
1.	Visual	50
2.	Symbolic	50
3.	Verbal	50
Total Score		50

Table 6. Test results on first cycle.

No	Representation Ability Indicator	Average (%)
1.	Visual	50
2.	Symbolic	70
3.	Verbal	52
Total Score		57

activity, the teacher prepared and motivated students to carry out learning in line with the lesson plans that have been prepared. In whilst activity, the teacher applied contextual approach. In post- activity, the teacher reminded students of the material to be learned next meeting and provided independent assignments.

Cycle I was held on Tuesday, November 3rd, 2015 and Wednesday, November 4th, 2015, each meeting for 80 minutes or 2 lesson hours. Material presented was on Relations. The results of the first cycle observation especially on the ability of teachers to carry out learning in Relations material using assisted worksheets are as Table 4. The observation on mathematical representation ability has

been done by observer to fill in the observation sheet provided by the researcher. The result of the first cycle observation can be seen Table 5.

The test results on mathematical representation was taken at the end of every cycle using mathematical representation ability problems arranged by the researcher. The result of the first cycle can be seen in the following Table 6. Second cycle was held on Tuesday, Wednesday, Thursday on November 10th, 11th, and 12th in 2015, each meeting for 80 minutes or 2 hours of lessons. Material presented was about Functions. The results of the second cycle on the ability is as Table 7.

Table 7. Teacher's ability on second cycle.

No	Activity	Average
1.	Pre- Activity	3,33
2.	Whilst Activity	3,25
3.	Post- Activity	2
Total Score		3,12

Table 8. Observation result in second cycle.

No	Representation Ability Indicator	Average (%)
1.	Visual	63,33
2.	Symbolic	55
3.	Verbal	60
Total Score		59,44

Table 9. Test results on second cycle.

No	Representation Ability Indicator	Average (%)
1.	Visual	75
2.	Symbolic	72,5
3.	Verbal	60
Total Score		69,17

Observations on the ability of mathematical representation are carried out by observers using observation sheets prepared by the researcher. The results of second cycle observation can be seen in the following Table 8. The tests of the mathematical representation ability were carried out at the end of each cycle using the mathematical representation ability problems compiled by the researcher. The results of the second cycle test can be seen in the following Table 9.

Third cycle was held on Tuesday, Wednesday and Thursday, November 17th– 19th, 2015. Each meeting was for 80 minutes or 2 lesson hours. Material presented was about Functions. The result of the third cycle

observation was as follows Table 10. Observation on mathematical representation ability was carried out by the observers using observation sheets prepared by researchers. The results of cycle III observations can be seen in the following Table 11. The mathematical representation ability tests were carried out at the end of each cycle using the questions compiled by the researcher. The results of the second cycle test can be seen in the following Table 12.

After finishing the third cycle it was found that there was a significant increase, seen from the implementation of learning and student learning outcomes. Even though the increase was not all 100%, but it was considered to be saturated so that the

cycle must be stopped. As a result, the researcher and observers agreed that the research was only carried out until the third cycle.

After doing 3 cycles of research on learning Relations and Functions material in eighth grade class using the student worksheet- assisted contextual approach conducted by the researcher, the recapitulation of teacher's ability to conduct learning using a contextual approach assisted by worksheets to eighth grade students of Batu Ampar can be seen in this following Table 13. Based on observation results that have been made there was an increase from the first cycle to the third cycle, with a score of 2.5 in the first cycle and increased to 3.12 in the second cycle, and then increased to 3.5 in the third cycle with good score criteria. It can be concluded that the ability of teacher in implementing mathematics learning using a contextual approach assisted by worksheets had increased.

Observations recapitulation on representation ability of students from Junior High School 3 is as follows Table 14. Based on the observation results of the mathematical representational ability of eighth grade students at Junior High School 3, Batu Ampar, the increase in each cycle can be seen clearly. Based on the results, there was an increase from the first cycle to the third cycle, with an average percentage of appearance of 50% in the first cycle and increased to 59.44% in the second cycle, and then increased to 74.17% in the third cycle. It can be concluded that the mathematical representation ability of students has gradually increased.

The recapitulation of results is as follows. Table 15. Based on the results of the test of mathematical representation ability of the eighth grade students, it can be seen that the increase occurs in each cycle. Based on the observation results, there is an increase from cycle I to cycle III, with an average percentage of test score 57% in cycle I and increase to 69.17% in cycle II, and then increase to 80.83% in cycle III. So that it can be concluded that the ability of students' mathematical representation has increased.

The followings are examples of student answers that show mathematical representation skills (visual, symbolic, and verbal). Based on the recapitulation of teacher's ability to apply contextual approach assisted by students' worksheet in learning, it can be seen that there is an increase in each cycle.

In this study, researcher applied the four stages in classroom action research, there were: planning, implementation, observation, and reflection. In improving the learning process; teacher actions, the ability of students' mathematical representation and learning outcomes in each learning cycle have changed in several ways, to be summed up as follows: Enhancing teacher's ability to conduct the learning process.

Based on teacher observation sheets, from first cycle to the third cycle, there is a difference in the average increase of 1. From the average score of third cycle, the teacher's actions in learning process were assessed well by the observer. The use of student's worksheets in learning

Table 10. Teacher's ability on third cycle.

No	Activity	Average
1.	Pre- Activity	3,67
2.	Whilst Activity	3,63
3.	Post- Activity	3,26
Total Score		3,50

Table 11. Observation results on third cycle.

No	Representation Ability Indicator	Average (%)
1.	Visual	93,33
2.	Symbolic	62,50
3.	Verbal	66,67
Total Score		74,17

Table 12. Test results on third cycle.

No	Representation Ability Indicator	Average (%)
1.	Visual	77,50
2.	Symbolic	75
3.	Verbal	90
Total Score		80,83

process has helped teachers in implementing learning. Gazali, R. Y (2016: 184) states that "Learning activities both in classroom implementation, as well as those contained in student's worksheet should be associated with daily life and designed as activities that are fun for students, so that learning activities experienced by students will be more meaningful to them". This opinion is in line with the implementation of contextual approach where an increase in teacher's ability is visible in learning.

The ability of mathematical representation

In each cycle starting from first cycle and followed by the next two cycles, the students' ability of math-

ematical representation also increases. Increased ability of mathematical representation occurs in visual, symbolic, and verbal aspects, especially on following indicators: 1) change different visual representations in the form of diagrams, graphs or tables given; 2) make a visual representation of a mathematical problem; 3) make a different symbolic representation of an equation or mathematical expression given; 4) make symbolic representations to clarify and solve problems; 5) use symbolic representation to explain mathematical concepts; 6) express visual representation in the form of verbal representation; 7) declare steps for solving problems through verbal representation (written text).

Table 13. Recapitulation of teacher's ability.

No	Activity	Cycle		
		I	II	III
1	Pre- Activity	2,67	3,33	3,67
2	Whilst Activity	2,67	3,25	3,63
3	Post- Activity	1,25	2	3,26
Average Score		2,50	3,12	3,50

Table 14. Recapitulation of Observation Results.

No	Representation Ability Indicator	Cycle(%)		
		I	II	III
1	Visual	50	63,33	93,33
2	Symbolic	50	55	62,50
3	Verbal	50	60	66,67
Average Score		50	59,44	74,17

Table 15. Recapitulation on Mathematics Representation test results.

No	Representation Ability Indicator	Cycle(%)		
		I	II	III
1	Visual	50	75	77,50
2	Symbolic	70	72,5	75
3	Verbal	52,5	60	90
Average Score		57,5	69,17	80,83

In addition, as seen in Table 14, there is an increase in each aspect of mathematical representation ability. Among the three aspects of representation ability, the visual aspect experienced the highest increase. This increase occurs since students in groups have begun to be able to solve questions using tables, graphs, and diagrams.

The increase in the ability of mathematical representation is due to students getting used to using various aspects of the mathematical representation in solving problems they face. Even though it has experienced an

increase, this needs to be maintained or improved again especially to generate student motivation towards mathematics and improve student learning outcomes.

Mathematical Representation Ability Test Results

Based on the results of the mathematical representation ability test, it can be seen the increase occurs in each cycle. Looking at the percentage as in Table 13, there is an increase in each aspect of mathematical representation ability.

In addition, the similar thing

Figure 1. Example of student answers for visual representation.

$$f(x) = 18.000x$$

$$90.000 = 18.000x$$

$$18.000x = 90.000$$

$$x = \frac{90.000}{18.000}$$

$$x = 5$$

Banyaknya uang yang diperoleh dengan uang 90.000 adalah 5 kg.

Figure 2. Example of student answers for symbolic Representations

also happened in Table 15. Of the three aspects of representation ability, the verbal aspect reaches the highest improvement. This increase occurs because students are getting used to apply various aspects of the mathematical representation ability to solve the problems they face. Even though it has experienced an increase, this needs to be maintained or improved continuously especially to generate student motivation towards mathematics and improve student learning outcomes.

The results of this study become a motivation for teachers in creating better learning quality as according to Hudiono (2008: 58) that "Teachers need to pay more attention to children's informal knowledge, link it to the school atmosphere, and provide opportunities for students to develop formal mathematical knowledge, for example representing events - physical events in various representation models: tables, graphics, verbal, symbolic, or other descriptions. "This is certainly beneficial for the teacher because it will

Figure 3. Example of student answers for verbal representations.

not only improve its competence but also will be a reference source for students' abilities as according to Rangkuti (2014: 115), he states that "On the other hand, the representations made by students have given the teacher the opportunity to know and access how students think about mathematics."

For example, from Table 15, the data obtained on the test results of mathematical representation ability in first cycleshows that among the three representation capabilities, the visual representation is in the lowest position while the symbolic representation ability is in the highest position. It turns out that the low ability of visual representation was also stated by Hudiono (2005: 4) who obtained the result that the students seem more prolific in mastering symbolic representations especially arithmetic ability thanmastering the visual aspect. By obtaining data in first cycle, it has encouraged teacher as researcher to maximize the development of students' visual representation ability in the next cycle.

Not only for teachers, the use

of representation in learning has a positive impact on students as stated by Sabirin (2014: 43) who states that "Mathematical learning in classroom should provide sufficient opportunities for students to train and develop mathematical representation skills." Improvement on mathematical representation ability visually, symbolically, and verbally is based on the observation results and test results given during the three research cycles. For example, an increase in the ability of visual representation can be seen from Figure 1 where students present data in graphical form based on the data stated in the diagram. For the ability of symbolic representation, it can be seen from Figure 2 where students use variables in determining problem solving. For the ability of the verbal representation, it can be seen from Figure 3 where students present stories based on the data presented in the diagram.

The results of this study indicate that representation is an important element in learning mathematics because it encourages students to solve a problem easier and be-

comes a means of delivering their ideas to both students and teacher. This is in line with Hartoyo (2010: 2) who states that "When students are familiar with representation and can represent their ideas, they get a set of tools to develop their capacity to think mathematically." Meanwhile, Muhamad (2016: 13) states "The use of appropriate and adequate representation will have a very large contribution to the formation of understanding (understanding or meaning) concepts." While Hudiono (2008: 58) states that "A problem that is considered complicated or complex can be simplified if the strategy and utilization of mathematical representations are applied in accordance with these problems". With the formation of a good understanding of a concept, students can analyze the way to solve a problem either by using one type of representation or some types of representation.

CONCLUSION AND SUGGESTION

Based on the results of research obtained through research on the ability of mathematical representation in relations and functions material using a contextual approach- assisted worksheets for the eight grade students of Junior High School 3 Batu Ampar, it can be concluded that the study was conducted in 3 cycles, where the results showed that: 1) contextual approach can improve students' mathematical representation abilities in visual, verbal, and symbolic aspects; 2) Increased ability of mathematical representation can encourage students to be more creative

in presenting ideas in solving mathematical problems.

Based on the results of research and conclusion in this study, it can be suggested as follows: 1) Since students' abilities are varied, the teacher should be observant in seeing the classroom conditions when using this approach to anticipate the progress of both fast and slow learners; and 2) The use of contextual approach in order to improve students' mathematical representation ability can be applied not only through material Relations and Functions, but can also be applied to other materials.

DAFTAR PUSTAKA

- Departemen Hukum dan HAM. (2015). *Peraturan Pemerintah Republik Indonesia No. 13 Tahun 2015*. Jakarta: Departemen Hukum dan HAM.
- Departemen Pendidikan dan Kebudayaan. (2016). *Peraturan Menteri Pendidikan dan Kebudayaan No. 20 Tahun 2016*. Jakarta: Pendidikan dan Kebudayaan.
- Departemen Pendidikan dan Kebudayaan. (2016). *Peraturan Menteri Pendidikan dan Kebudayaan No. 24 Tahun 2016*. Jakarta: Pendidikan dan Kebudayaan.
- Gazali, Y.R. (2016). Pengembangan Bahan Ajar Matematika untuk Siswa SMP Berdasarkan Teori Belajar Ausubel. *Pythagoras: Jurnal Pendidikan Matematika*. Volume 11 No. 2, (182-192).

- Hartoyo, A. (2010). Mode Representasi Ide Dalam Belajar Matematika. *Jurnal Pendidikan Matematika dan IPA. Vol. 1. No. 1.* 1-10.
- Hudiono, B. (2005). *Peran Pembelajaran Diskursus Multi Representasi terhadap Pengembangan Kemampuan Matematik dan Daya Representasi pada Siswa SLTP.* Disertasi. Bandung: Universitas Pendidikan Indonesia.
- Hudiono, B. (2008). Peran Representasi Dalam Meningkatkan Pemahaman Siswa Pada Materi Persamaan Garis. *Jurnal Didaktika. 9(1),* 57-68.
- Hutagaol, K. (2013). Pembelajaran Kontekstual Untuk Meningkatkan Kemampuan Representasi Matematis Siswa Sekolah menengah Pertama. *Infinity Journal. 2(1),* 85-99.
- Hwang, W. -Y., Chen, N.-S., Dung, J.-J., Yang, Y.-L. (2007). Multiple Representation Abilitys and Creativity Effects on Mathematical Problem Solving using a Multimedia Whiteboard System. *Educational Technology & Society. 10(2),* 191-212.
- Kartini. (2009). Peranan Representasi dalam Pembelajaran Matematika. *Prosiding Seminar Nasional Matematika dan Pendidikan Matematika 2009 "Penelitian dan Pendidikan Matematika serta kontribusinya dalam Upaya Pencapaian WCU (World Class University)"*(pp. 361-371). Yogyakarta: Universitas Negeri Yogyakarta.
- Muhamad, N. (2016). Pengaruh Metode *Discovery Learning* untuk Meningkatkan Representasi Matematis dan Percaya Diri Siswa. *Jurnal Pendidikan Universitas Garut. Vol. 09. No. 01.* 9-22
- Sabirin, M. (2014). Representasi dalam Pembelajaran Matematika. *Jurnal Pendidikan Matematika. Vol. 01No. 2.* 33-44.
- Sanjaya, W. (2008). *Pembelajaran dalam Implementasi Kurikulum Berbasis Kompetensi.* Jakarta: Kencana Prenada Media Group.
- Soesatyo, Y. dkk. (2017). Pelatihan Penulisan Proposal Penelitian Tindakan Kelas (PTK) Bagi Guru Ekonomi Kabupaten Sidoarjo. *Jurnal Pemberdayaan Masyarakat Madani (JPMM). Vol. 1 No. 2 Desember 2017.* 165-166.