DECISION MAKING IN POLICY LEARNING MODEL THROUGH STUDENT MATHEMATICS REPRESENTATION ABILITY TEST IN LEARNING TWO VARIABLE LINEAR EQUATIONS

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ABSTRACT

This study aims to make decisions about learning model policies by exploring students' mathematical representations in learning mathematics. The benefit of the ability to represent mathematics is that it facilitates problem-solving. Students need to train and develop things related to mathematical representation in a lesson. The form of mathematical representation used is a visual representation, making mathematical models, and using words in problem-solving. From the results of the study, it was found that the students' mathematical representation skills were linear equations of two variables, namely students as the first subject in the very capable category of students fulfilling complete and very good mathematical representations. Students with moderate academic ability in the second subject and meeting the mathematical representation ability were quite good, while students in the third subject with existing indicators had incomplete results and did not meet the mathematical representation.

Keywords: *decision making, mathematical representation, visual representation, two-variable linear equation*

A. INTRODUCTION

The *Peraturan Menteri Pendidikan dan Kebudayaan Nomor 21 Tahun 2016* states that the competencies that are expected to be possessed by students are having confidence in the power and usefulness of mathematics formed through learning experiences and having the ability to communicate mathematical ideas clearly. One of the student's ability to communicate ideas is to make mathematical representations. To solve mathematical problems also requires knowledge of mathematical representations in communicating ideas or ideas.

Therefore, the right decisions are made in the learning classroom. Decision making according to Siegel (1989) is related to the process of thinking, managing, and solving problems. Decision making is defined as the process of choosing among various alternative actions now that will affect the future. The decision-making process is influenced by the level of experience that the individual has.

Based on that, it is necessary to conduct research on classroom action. Sanjaya in his book Classroom Action Research (2009) states that classroom action research is a process of investigating learning problems encountered in the

classroom, including finding solutions to solve these problems through planned actions.

Learning Mathematics will be better mastered if it is done from the beginning (Ainy, Shoffa, & Soemantri, 2019). One of the compulsory and worldwide subjects is mathematics. with mathematics, science and technology are increasingly advanced because they can train higher-order thinking skills (Alimuddin & Trisnowali, 2018). According to Setyono (in Andri, et al, 2020) that mathematics is important in and for our lives. By learning basic mathematics, it can be in the form of number recognition, counting, counting, and other mathematical activities. The success of learning mathematics is successful if it can produce students with various abilities (Rianti, 2018). Learning mathematics has a purpose in addition to being fluent in the material, it can also improve various kinds of abilities. One of them is the ability to solve problems, find a solution to a problem, and analyze the solution (Rohyana and Ibrahim, 2021). According to NCTM (2000) also states that the ability to understand and represent mathematics is important for learning mathematics. The form of student interpretation of a problem is used as a tool to solve the problem (Sabirin, 2014).

According to Saud (in Andri, et al, 2020) that the task of a teacher at school is to guide students in understanding until they are able to solve problems. Various subject matter is also given by the teacher at school, one example is mathematics. According to Mainali (2021) representation is also an important factor in learning mathematics so that it is expected to improve mathematics learning outcomes. Students are expected to be able to understand the material after learning something. Indicators of the learning process are successful if students can solve problems (Nuraeni & Afriansyah, 2016). According to Yeni and Sukmawati (2020) one of the things to be successful in learning mathematics is the ability to represent mathematically.

Yuniarti (2013) states that various forms of mathematical representation are verbal representations, pictures, numeric, algebra, tables, diagrams, and graphs are basic learning components that cannot be separated in mathematics. In general, in learning mathematical representations, it is not the main focus. Mathematical representations are taught as a complement to solving problems.

Andri, et al (2020) mention that there are factors that cause student learning difficulties, namely from students, teachers and the environment. Improving student learning outcomes is supported by effective learning and the role of parents, so that effective learning can be beneficial to students (Dakhi, 2020). This shows that the environment affects students in learning. A study showed the low results of students' daily assessments due to their low mathematical representation (Suningsih and Istiani, 2021). According to Miladiah, et al (2020) mentioning the ability of students' mathematical representation in the form of words to solve linear programming problems is also low. Likewise, according to Hartono, et al (2019), the mathematical representation ability of students is still lacking. This can be seen from the students' answers which were analyzed by the researcher. The answer is functional but can't give a reason why. The existence of research that shows about learning outcomes and the low mathematical representation of students, this researcher focuses on the activities of mathematical representation of linear

equations of two variables, as the basis for decision making in class action learning.

B. RESEARCH METHODS

This research field research type was conducted using qualitative descriptive. The study was conducted on random classes and subjects. The material used is linear equations of two variables for grade 8 mathematics. Students are given questions about the material of linear equations of two variables and are asked to solve them within a certain time. The question consists of two numbers and the intended indicator is that students can show a mathematical representation in the answer. There were three students who were selected in the category of students with good, moderate and poor abilities. From the results of their answers were analyzed in terms of mathematical representation according to indicators. Then the researcher presents the results of the analysis and makes conclusions, and that can be used as the basis for making decisions for class action.

C. RESULTS AND DISCUSSION

According to Syafri (2017) several indicators that can be used to determine the level of student representation are as follows: a. Representation in the form of images includes: Creating geometric figures to clarify problems and facilitate their resolution; b. Representations in the form of mathematical expressions include: Creating a mathematical model of the given problem; Solving problems involving mathematical expressions; c. Representations in the form of written text include: Answering questions using written text.

Endang (2016) uses an assessment rubric in measuring mathematical representation abilities, according to the topic of the material discussed, the following assessment rubric is adjusted by the researcher: A. Complete and fulfill the representation ability very well if: 1. Students present data in the form of mathematical expressions by providing complete and correct illustrations; 2. Students answer questions using words or written texts accurately and logically; 3. Students can use visual representations/pictures and can solve problems correctly and with complete explanations; B. Complete and meet mathematical representation skills well, if: 1. Students present data in the form of mathematical expressions by providing incomplete illustrations but there are still errors; 2. Students answer questions using words or written texts that are logical but not precise; 3. Students use visual representations/pictures to solve problems correctly and completely but there are still a few errors of reasoning; C. Complete and meet sufficient mathematical representation ability, if: 1. Students present data in the form of mathematical expressions by providing incomplete and correct illustrations; 2. Students answer questions using words or written texts that are incomplete and correct; 3. Students use visual representations/pictures to solve problems correctly but do not write down the reasons completely; D. Incomplete and does not meet the mathematical representation, if: 1. Students present data in the form of mathematical expressions by providing incomplete illustrations and there are many errors; 2. Students answer questions using words or written text that is incomplete and incorrect; 3. Students

use visual representations/pictures to solve problems incorrectly and do not write down the reasons completely; E. Incomplete and does not meet the mathematical representation, if: 1. Students do not present data in the form of mathematical expressions; 2. Students do not answer questions using words or written text; 3. Students use visual representations/pictures to solve problems incorrectly and do not write down the reasons at all.

The following is a discussion of the results of research that has been carried out on three subjects. Students with good learning outcomes are referred to as the first subject, students with moderate learning outcomes are the second subjects. Meanwhile, students with less learning outcomes are referred to as the third subject. Questions are given together and done in approximately 60 minutes. The picture of the questions done by the students (figure 1) and the results of the students' answers are as follows:

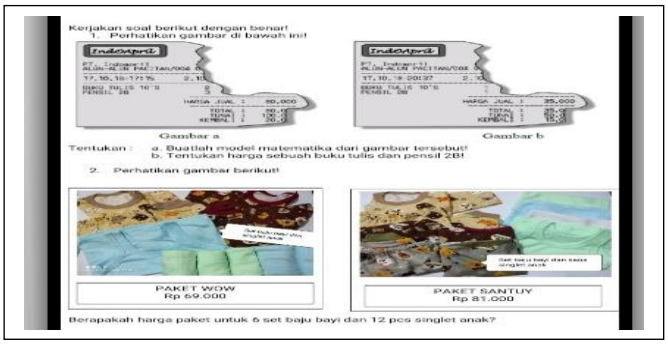

Figure 1

1. First Subject

The subject worked on question number 1 after seeing the picture then the subject presented the data in the form of a mathematical expression by providing a complete and correct illustration. The subject writes an example of the picture. The subject then made the equation completely and correctly as shown in Figure 2 below:

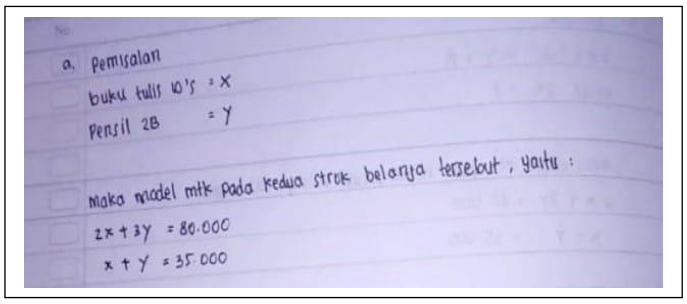

Figure 2

After writing the example, the subject made a linear equation of two variables and made a mathematical model from the picture, the subject worked on the next steps, namely writing down how to work on the written question correctly and logically. Subjects have also shown mathematical representations visually and

can solve problems correctly and with complete explanations. This can be seen in Figure 3 below:

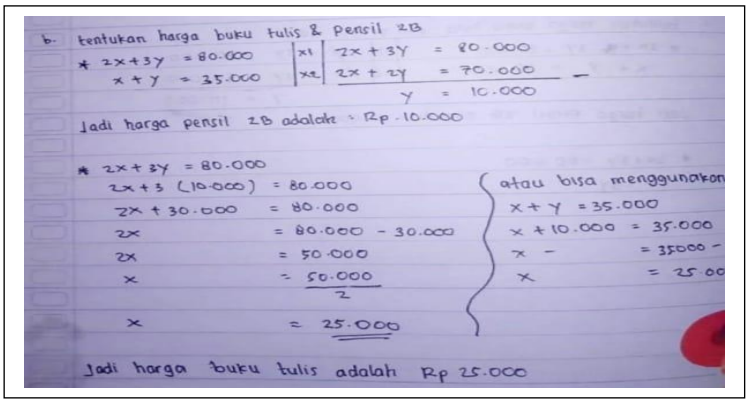

Figure 3

The first subject to work on problem number 2, has also shown that he can express mathematically by providing complete and correct illustrations. The subject writes an example to relate the picture to the making of a mathematical model. This can be seen in figure 4:

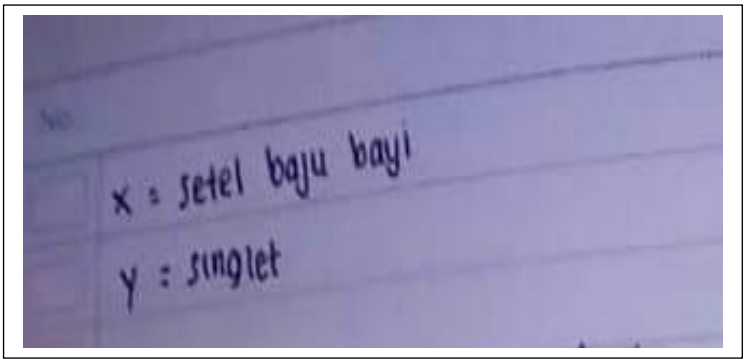

Figure 4

The next step is the subject is able to answer questions using words or written texts appropriately and logically and is able to solve problems correctly and with complete explanations. The following is the result of Figure 5:

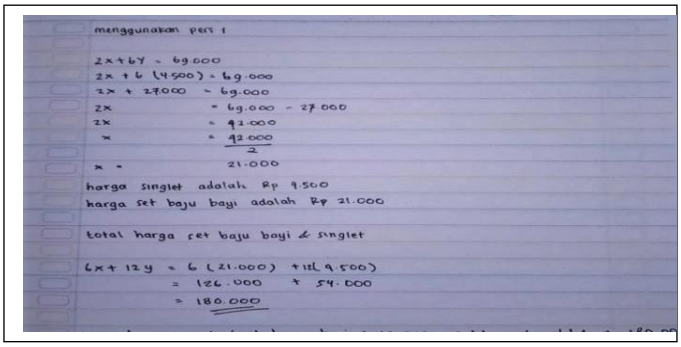

Figure 5

2. Second Subject

The second subject worked on the first problem by presenting the data in the form of a mathematical expression, namely providing an illustration that was almost correct but incomplete. Subjects have not provided examples of words as a form of liaison between images and making mathematical models. Here's picture:

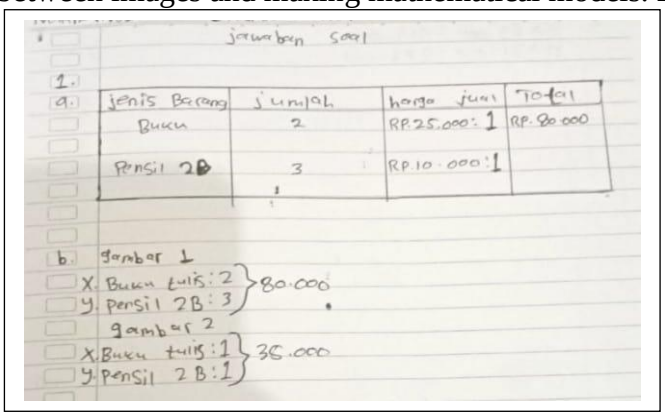

Figure 6

The next activity by subject 2 is to write in words or written text in answering questions. The subject describes the picture and makes a logical but not precise mathematical model. There are several steps that are not correct, namely in writing a mathematical model if the coefficient is 1 then it does not need to be written as in Figure:

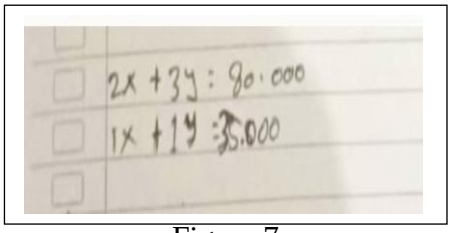

Figure 7

The subject wrote down the next step as a form of solving the problem correctly but incomplete. There are steps that are not clearly written from the initial mathematical model to the next step so that x has a coefficient that was not equal to be the same. The first equation for the coefficient of x is 2, while the second equation for the coefficient of x is 1. However, in the next step, the coefficient of x becomes equal. This is shown in figure 8:

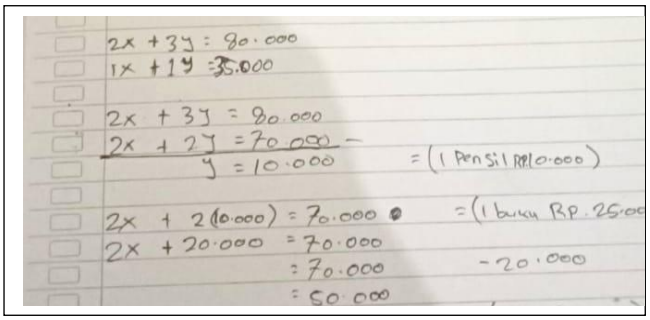

Figure 8

In question number 2, the second subject does not present the data as a form of mathematical expression. The subject only wrote down the steps to answer the question, but the steps were logical, only incomplete in providing the steps. Subjects also wrote down mathematical words but were wrong. The following is the answer to the second subject in Figure.

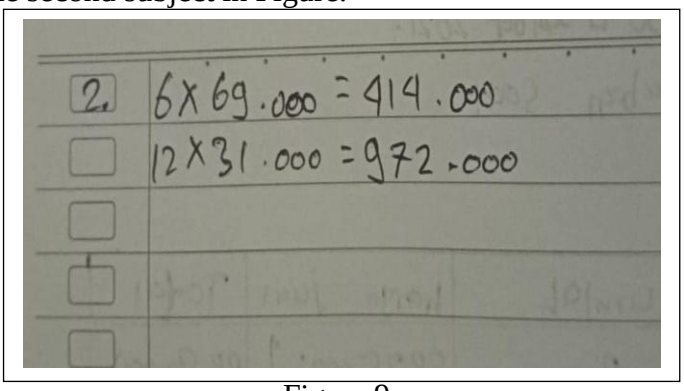

Figure 9

3. Third subject

Figure 3a shows the activity of subject 3 in answering question 1, namely there is a mathematical expression but it is not complete and there are still errors. The subject also did not write the example as the relationship between the picture of the problem and the mathematical model to be made as shown in the following figure:

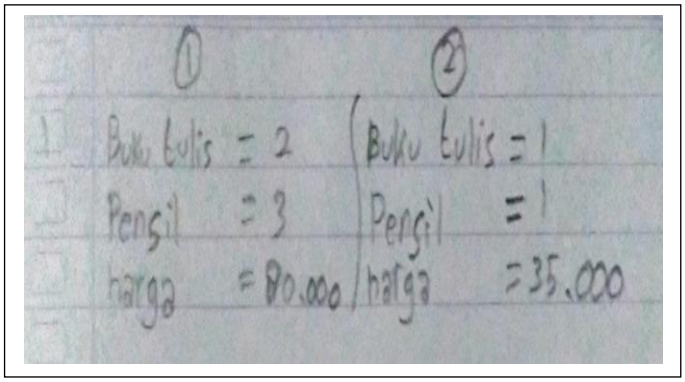

Figure 10

The third subject writes in the form of mathematical words but is not yet accurate for the results. When writing the linear equation, the subject prioritizes numbers over variables, so the mathematical model is less precise. For example B2 should be 2B as well as for pencils that are known to have 3 written P3 should be 3P. However, the steps used are correct, namely showing the existence of an elimination method by multiplying so that it matches the LCM (least common multiple) of one of the same variables. The error that occurs is when the KPK has obtained for the same variable but is not reduced so that the results are less precise. Figure 3b shows the mathematical representation by three subjects:

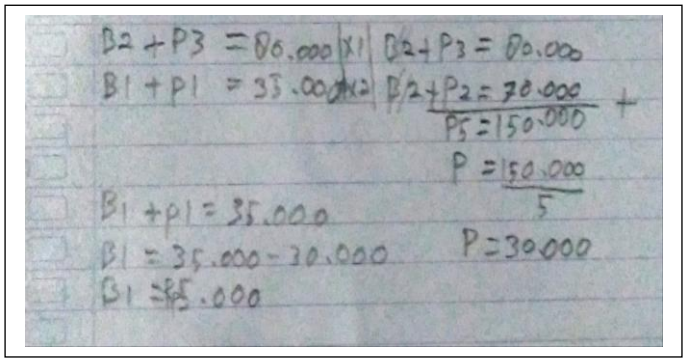

Figure 11

Subject 3 used visual representations/pictures to solve problems incorrectly and did not write down the reasons completely. The subject wrote down the steps in doing the problem but the result was wrong. When the subject has found the answer to the first variable and the answer is wrong, the answer to the second variable is also wrong (figure 12).

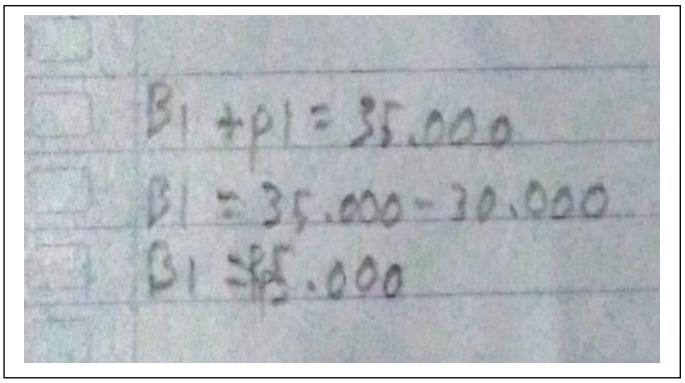

Figure 12

Based on the results for the three subjects above, in a mathematical representation of a linear equation of two variables, it is obtained that:

1. The first subject is complete and fulfills the ability to represent very well. This is comparable to the research conducted by (Suningsih et al., 2021) which states that the mathematical representation ability for students' visuals is good and in accordance with the indicators. The same research was also conducted (Purnama, et al, 2019) which stated that students in the high group (high ability) knew the steps to complete and calculate properly and correctly and use the right equation. According to (Nurpadilah et al., 2018) which states high group students in high visual representation, medium category for symbol representation. The verbal/word mathematical representation is in the medium category.
2. The second subject is complete and fulfills the mathematical representation ability quite well. This is in accordance with research (Purnama et al, 2019) which states that in the medium group students can complete and calculate well and can make the right equation, but there are still errors in results due

to lack of accuracy. In addition, verbal mathematical representation skills in the high group are also categorized as good. For the mathematical representation ability, the medium group for verbal was categorized as less. In accordance with the results of research (Nurpadilah et al., 2018) which states that students with moderate abilities have moderate visual abilities, medium symbol representation, and low word representation abilities.

3. The third subject is incomplete and does not meet the mathematical representation. Along with (Purnama et al, 2019) the verbal mathematical representation ability in the low group is classified as lacking. Then in terms of understanding the problem, it is categorized as not understanding so that it is sufficient to complete and calculate. Research conducted (Nurpadilah et al., 2018) also shows that the visual representation they have is moderate, students' ability to represent symbols is low, and very low for the category of verbal representation or words.

D. CONCLUSIONS AND SUGGESTIONS

The conclusion from the results of the analysis of students' mathematical representation abilities on linear equations of two variables, namely students as the first subject in the category of high-ability students met complete and very good mathematical representation. Students with moderate academic ability as the second subject completed and met the mathematical representation ability quite well, while students as the third subject with existing indicators had incomplete results and did not meet the mathematical representation. So that the decision made is a class action in the form of habituation of students in their own opinion through question and answer. Suggestions for the next step is that the teacher provides more guidance so that students are accustomed to having their own opinions through question and answer, providing exercises in the form of examples of variations both through pictures and verbally and giving assignments to students in analyzing something.

REFERENCES

Agustin Sukses Dakhi. (2020). Peningkatan Hasil Belajar Siswa. *Jurnal Of Education and Development,* 8(2), 468-470. https://journal.ipts.ac.id/index.php/ED/article/view/1758/889

Ainy, C, Shoffa, S., & Soemantri, S. (2019). Lesson Study Sebagai Sarana Meningkatkan Kemampuan Mengajar Dosen dan Kualitas Pembelajaran dalam Perkuliahan Mata Kuliah Kalkulus I. *Jurnal Riset Pendidikan Dan Inovasi Pembelajaran Matematika (JRPIPM),* 1(2), 82. https://doi.org/10.26740/jrpipm.v1n2.

Alimudin. H, dan Trisnowali. A. (2018). Profil Kemampuan Spasial Dalam Menyelesaikan Masalah Geometri Siswa Yang Memiliki Kecerdasan Logis. *Histogram: Jurnal Pendidikan Matematika,* 2(2), 169-182

Andri, Olenggius. J. D, & Anastasia. H. L. (2020). Analisis Faktor Penyebab Kesulitan Belajar Matematika Pada Siswa SDN 01 Nanga Kantuk. *J-PiMat*, 2(1), 158-167

Hartono, M. Firdaus, & Sipriyanti. (2019). Kemampuan Representasi Matematis Dalam Materi Fungsi Dengan Pendekatan *Open* Ended Pada Siswa Kelas VIII MTs Sirajul Ulum Pontianak. *Eksponen*, 9(1), 9-20

Kusumah, Endang Cahya. (2016). Peningkatan Kemampuan Representasi Matematis Siswa Melalui Model Means-Ends Analysis Dalam Pembelajaran Matematika. Universitas Pendidikan Indonesia

Mainali, B. (2021). Representation In Teaching and learning Mathematics. *IJEMST*, 9(1)

Miladiah, A, Nurhaida, & Nurul. I. K. (2020). Analisis Kemampuan Representasi Matematis Siswa Dalam Menyelesaikan Soal Cerita Program Linear. *Jurnal Riset Pembelajaran Matematika Sekolah(JRPMS)*, 4(2), 9-14

Muhtarom, A., Syairozi, I., & Wardani, N. D. (2022). ANALISIS PERSEPSI HARGA, KUALITAS PELAYANAN, CUSTOMER RELATIONSHIP MARKETING, DAN KEPERCAYAAN TERHADAP PENINGKATAN PENJUALAN DIMEDIASI LOYALITAS PELANGGAN PADA UMKM AYAM POTONG ONLINE ELMONSU. *Jesya (Jurnal Ekonomi dan Ekonomi Syariah)*, *5*(1), 743-755.

Muhtarom, A., Syairozi, M. I., & Yonita, H. L. (2022). Analisis Persepsi Harga, Lokasi, Fasilitas, dan Kualitas Pelayanan terhadap Loyalitas Pelanggan Dimediasi Keputusan Pembelian (Studi Kasus pada Umkm Skck (Stasiun Kuliner Canditunggal Kalitengah) Metode Structural Equation Modelling (SEM)-Partial Least. *EKOMBIS REVIEW: Jurnal Ilmiah Ekonomi dan Bisnis*, *10*(S1), 391-402.

NCTM. (2000). *Principles and Standards for School Mathematics*. Reston, VA: NCTM.

Nisrina. N. F dan Dani. F.(2019). Analisis Kemampuan Representasi Matematis Siswa SMA Pada Materi Matriks. *Sesiomadika*, *Prosiding Seminar Nasional Matematika dan Pendidikan Matematika*. h: 971-979. http://journal.unsika.ac.id/index.php/sesiomadika

Nurpadilah E, Rohaeti E, Afrilianto M. (2018). Kemampuan Representasi Matematik Pada Materi Segi Empat Siswa SMP Kelas VII. *JPMI*. 1(4), 765-772

Purnama N, Kusmaryono I, Basir A. (2019). Analisis Kemampuan Representasi Matematis Siswa Kelas VIII SMP Al Fattah Semarang. *Kontinu: Jurnal Penelitian Didaktik Matematika*. 3(1), 23-36

Rohyana. N. N, dan Ibrahim. (2021). Profil Kemampuan Pemecahan Masalah Matematis Siswa Kelas VIII MTs Pada Materi Lingkaran. *Histogram: Jurnal Pendidikan Matematika*, 5(2), 205-217

Sabirin, M. (2014). Representasi Dalam Pembelajaran Matematika. *JPM IAIN Antasari*, 1(2), 33-44

Samsuddin. A. F, dan Retnawati. H. (2018). Mathematical Representation : the roles, challenges and implication on instruction. *J. Phys.: Conf. Ser.* 1097 012152.

Sapitri, Ita dan Ramlah. (2019). Kemampuan Representasi Matematis dalam Meyelesesaikan Soal Kubus dan Balok pada Siswa SMP. *Sesiomadika*

: *Prosiding seminar nasional matematika dan pendidikan matematika*. h. 829-835

Siegel, H. (1989). Epistemology, critical thinking, and critical thinking pedagogy. Argumentation, 3, 127-140.

Silviani. E, Mardiani. D, & Sofyan. D. (2021). Analisis Kemampuan Representasi Matematis Siswa SMP Pada Materi Statistika. *Mosharafa*. Vol. 10(3), 483-492

Syafirin, Fatrima. S. (2017). Kemampuan Representasi Matematis dan Kemampuan Pembuktian Matematika. *Jurnal Edu Math*, 3(1), 49-61

Syairozi, M. I. (2019). Keterkaitan Variasi Produk dan Tenaga Kerja Terhadap Peningkatan Laba Bengkel AHAS PANDAAN. In *The Relation of Product Variations and Labor to Increase in Profit at AHAS PANDAAN Workshop*.

Suningsih. A dan Istiani, A. (2021). Analisis Kemampuan Representasi Matematis Siswa. *Mosharafa:Jurnal Pendidikan Matematika,* 10(2), 225-234

Wina Sanjaya. (2009). Penelitian Tindakan Kelas. Jakarta: Kencana.

Yeni dan Sukmawati. R. (2020). Analisis Kemampuan Representasi Matematis Mahasiswa Berdasarkan Motivasi Belajar. *Mosharafa: Jurnal Pendidikan Matematika*, 9(2), 251-262

Yuniarti, Yuni. (2013). Peran Guru Dalam Meningkatkan Kemampuan Representasi Matematika Dalam Pembelajaran Matematika. *EduHumaniora*., 5(1)