Student Mathematical Representation Ability in Their Learning Habits During the Covid-19 Pandemic

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Abstract

The research aims to describe the mathematical representation abilities of students in their learning habits during the Covid-19 pandemic at SMAN 1 Buay Madang. The type of this research is qualitative descriptive. Data collection was carried out by giving the tests and interviewed to repondents. The test was given in the form of description questions in linear programming material for XI grade, then indicators of mathematical representation abilities such as verbal, symbolic and visual. The interview were conducted to obtain the accuracy of students' answers related to mathematical representation abilities and students' learning ahbits during the Covid-19 pandemic. The subjects were taken as many as to 3 students by appliying purposive sampling technique. The results students' answer showed that that students' mathematical representation ability is still low. In addition, visual representation ability is used to solve the pattern of problem into diagrams and tables in linear programming problems. Symbolic representation is to make problems into a mathematical model using the example of mathematical symbols. Then, the ability of visual representation is to provide an explanation of the stageswhich they are working on and conclusions in the from the final results. Moreover, the results of the interview regarding to students' habits showed that students have irregular learning habits during study at home. The students' learning habits did not have good result especially in the application of mathematical representations was not optimal to solve students' the problems.

Keywords
Mathemathical Representation, Learning Habits, Covid-19

1. Introduction

One of the effects of Covid-19 which is getting worse has a negative impact on the education system in several countries and various income levels (Tadesse & Muluye, 2020). In the short time, the living system was turned upside down that could not have been imagined before (Bjursell, 2020). The Covid-19 pandemic cannot confirm when the right time the case will stop. Because of Covid-19, the learning system has especially in the media and the provision of learning materials (United Nations, 2020). The turnover of students' learning habits due to Covid-19 has been done by the distance learning system. All the learning system in Indonesia has been changed from face-to-face learning system to online learning system (Fakhruddin & Shofwan, 2021). The learning system which is carried out in pandemic situation became the proof of the importance of education system which emphasizes in increasing the students' mathematical abilities.

Mathematical is the core of science (Trapsilasiwi et al., 2020). The imortance of mathematics knowledge is interesting to discuss, notably students' problem solving ability. In mathematical problem solving, the optimization of representation ability in the form of pictures, graphss, diagrams, and another form of representation ability are needed to communicate students' understanding (Fadhilah et al., 2019). Representation is one of the form of students' represenatation about the using of tools to solve the students' understanding in mathematics (Fathiya et al., 2020). One of the problem that students thought difficult but it will be understood easily if they can use the appropriate representation based on their problems, but the problem will be comlicated if they represented the problem in the in appropriate way (Gumilar et al., 2020), that cannot be denied if the mathematical things which is abstract can be used as the media representation which is expected can help students to understand mathematics learning materials (Widakdo, 2017).

Representations represent mathematical ideas and allow students to focus more on abstract mathematics (Jitendra et al., 2016). Mathematics requires representation because of the abstract nature of mathematics so that people have access to mathematical ideas only through the representation of those ideas (Minarni et al., 2016). When students create, compare, and use their representations, students can develop their understanding of mathematical relationships and concepts (Wahyuni et al., 2020)

The importance of having skills in mathematical representation because the ability of representation is the key to finding the right solution to solve mathematical problems (Hidayati et al., 2020). Mathematical representation must be emphasized in the process of learning mathematics because students' ability to represent problems can help them solve mathematical problems (Santia et al., 2019). Representation is a configuration process and a way of presenting something in another situation (Bal, 2015). So it is necessary to do representations in various forms of representation, such as verbal representations, images, numeric, symbols, algebra, tables and graphs (Rahmawati et al., 2017).

Students' representation mathematics will be easy to create the problem solving that faced by students. The mathematical representation ability is influenced by the students' development ability in mathematical representation. The development of mathematical representation can be indified by the students' habbits in learning activity. Students' good habbits will give the possitive impact to students' dicipline, radiness, and independence in their learning system (Fitrianti & Riyana, 2020)

Students' learning habits are not the same during the school year and holidays (Trung et al., 2020). Thus, learning carried out using distance learning due to COVID-19 also causes different habits when students learn directly in class. Their study habits may require some adjustments to comply with the online learning approach as well as being at home during the pandemic (Ghazali et al., 2021). Although learning is done online, it is important for students to have good study habits while learning is done remotely. The importance of having study habits is one of the factors that affect students' mathematics learning achievement (Hashim et al., 2021)

2. Literatur Review

2.1. Mathematical Representation

The representation ability is very important to develop the ability of mathematics problem solving. It is being the fifth standard after problem solving, reasoning, communication, and connecting (NCTM, 2000). The goals in learning mathematics regarding to NCTM (2000) is to develop several abilities such as mathematical communications, mathematical logic, mathematical problem solving, mathematical connections, and mathematical representation. Generally, mathematical representation is one of the goals in learning mathematics. However, students should try to understand the mathematical representation because it can be seen as the way to explain and symbolizes the concepts of mathematics (Iskak et al., 2020). Thus, having skills in mathematical representation is the key to finding the right solution to solve mathematical problems (Hidayati et al., 2020).

(Hoeppe, 2015) states that each meaningful representation of a step in the series of transformations of an understanding. Mathematical representation ability is the ability of students to construct a problem into another form (Kurniawan & Kuswanto, 2021). Representation involves a thought process carried out to capture and understand concepts as a reasoning tool in developing and expressing one's views on a problem (Sari & Darhim, 2020). So that mathematical representations in learning mathematics can enable students to interpret and solve problems easily (Supandi et al., 2018).

Mathematical representation is students' ability in understanding visual mathematical representation, symbolic mathematical representation, and verbal mathematical representation (Istadi et al., 2017). (Laelasari et al., 2020) declared that mathematical representation is the figuring, translating, describing, reappointment, the mining, modeling, mathematics conceptual idea, and correlation of configuration, construction, or situation which is showed in the various of shape to get the real meaning, in other word, it can represent or finding the solution of their problem. Moreover, (Samsuddin & Retnawati, 2018) explained that mathematical representation gives the students' possitive problem solving.

2.2. Learning Habits

The learning habbits is the way that owned by someone when they receive the learning materials such as reading the book, and setting the time to solve the activity (Leton et al., 2020). Habits can support or hold back valuable long-term goals, including outcomes related to and well-being of students (Fiorella, 2020). The effects of this habit are most evident when people have limited resources for self-control (Neal et al., 2006). A stable indicator of how students perceive, interact with, and respond to the learning environment (Shah et al., 2012).

The learning habbits showed do the students study regularly in every semester or not (Smail, 2017). The learning habbits divided into several aspects such as the duration of studying, the manner of studying, and social factors which related to self-understanding (Urh & Jereb, 2014). The impact of the Covid-19 pandemic requires students to study remotely (online). Students' learning habits from home and studying in class will have an impact on learning effectiveness. Learning habits in the class will be more effective (Okado et al., 2018). The eductors will be easily to control students along the process of learning activity when they are studying. It is very different if the learning system is done by study from home, the educators will be hard to control the students' learning activity (Shofwan et al. 2021). Therefore, the learning habbits showed the regularity of students' learning habbits (Au, 2012). Students' learning habits should match to students' learning duration in a week (Entwistle & Thompson, 1974). During this pandemic, researchers wanted to know students' representational abilities of their online learning habits during the Covid-19 pandemic.

3. Methods

This research is kind of quantitative descriptive research. qualitative research discusses about the description of students' mathematical representation in their learning ability during Covid-19 pandemic. The researcher conducted the research at SMA Negeri 1 Buay Madang. The subject of this research was 3 students at the XI grade of SMA N 1 Buay Madang. The subject was took by purposive sampling. The sampling technique was took based on the consideration of teacher or educators regarding to the ability of respondent who had the criteria such as good at solving the problem, sufficient in solving the problem, and low ability in solving the problem. The data collecting techique was by tri-anggulation technique in form of comparing the result of students' answer and the result from interview until the valid data was gotten. The data can be said to be valid if the students' answers relate to the results of the interviews. In this study, tests and interviews were used. The test given is in the form of math problems containing linear programming material. Then after the questions were analyzed, interviews were conducted asking the relevance of the answers and students' learning habits during the pandemic.

4. Results and Discussion

The process in collecting the data did by face to face and online learning process. The researcher met the respondent directly when they came to the school just for collecting their task. The researcher had 30 minutes to met students directly. The online learning was done by the researcher by giving the learning material in the form of picture, or task to know students' ability in understanding the learning material. The researcher sent the material via WhatsApp group. The data that collected by the researcher (test and interview) based on students' mathematical representation ability and their learning habits during Covid-19 pandemic. The researcher gave test to the respondent it was about linear program. The goals of giving test is to know students' representation ability. The questions given to students are in accordance with Figure 1 below:

> A flower shop sells 2 kinds of flower series. Series I require 10 roses and 15 carnations. Series II requires 20 roses and 5 carnations. The supplies of roses and carnations are 200 and 100 stalks. Series I is sold for Rp. 200,000.00 and series II is sold for Rp. 100,000.00 in each series. How is the form of a mathematical model of the problem? And how is the graphic image of the mathematical model problem?

Figure 1. The question who gave to students

The correct solution is as shown in Figure 2 below:

Let x is series I
   y is series II
- This shop has a supply of 200 roses, consisting of series I requires 10 roses and series II requires 20 roses.
- This shop also has a supply of 100 carnations, consisting of series I am requiring 15 carnation and series II 5 carnation.
- Series I is sold at Rp. 200,000.00 and series II are sold for Rp. 100,000.00

How is the form of a mathematical model of the problem?
And how is the graphic image of the mathematical model problem?

Answer:

Equation 1
$10x + 20y \leq 200$ simplified to be
   $x + 2y \leq 20$
Equation 2
$15x + 5y \leq 100$ simplified to be
   $3x + y \leq 20$
And for its function
$f(x,y) = 200x + 100y$

So, we get a mathematical model:
   $x + 2y \leq 20$
   $3x + y \leq 20$
   $x \leq 0$
   $y \leq 0$
$f(x,y) = 200x + 100y$

Finding a graphic image of a mathematical model problem:

Equation 1	Equation 2
$x + 2y = 20$	$3x + y = 20$
Let $x = 0$ maka $y = 10$. titik potong (0,10)	Let $x = 0$ maka $y = 20$ (0,20)
$y = 0$ maka x = 20 . titik potong (20,0)	$y = 0$ maka x = 6,7 dibulatkan $x = 7$ (7,0)

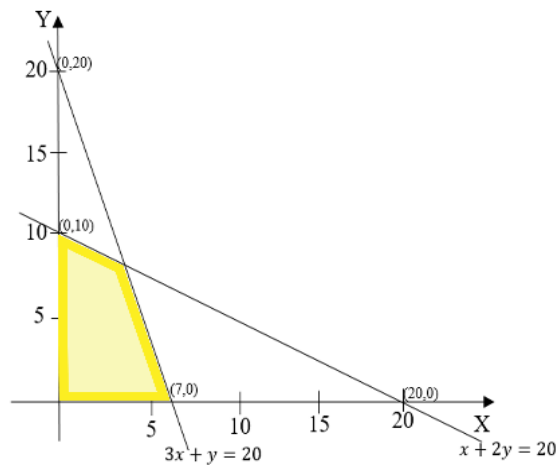So that the graph of the mathematical model needed is as follows,

Figure 2. The correct answer

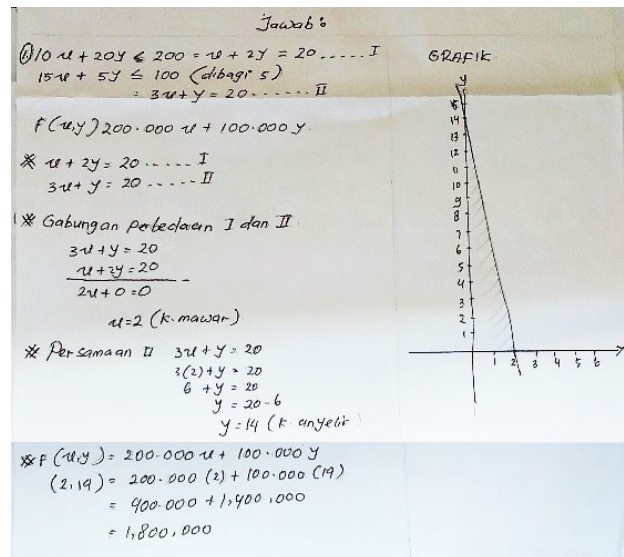The students' answer can be seen in the figure 3 below:

Figure 3. The students' (S1) answer sheet

The results of student answer sheets 1 or (S1) based on mathematical representation abilities are described in table 1 below:

Table 1. Mathematics Representation Ability by Students 1

Mathematical Representation Ability	Student Ability
Symbolic Mathematical Representation	Students' answers 1 or (S1) in representing the questions show that students are able to apply mathematical modeling symbolically, but there is an incorrect calculation operation.
Verbal Mathematical Representation	The form of the graph made based on the completed stages is imperfect in finding the intersection point of the equations of lines 1 and 2 is not quite right so the resulting graph does not match the problem. The visual ability of students is able to describe the graph, but because the process of finding the intersection point is not quite right, the resulting image is also not suitable.
Visual Mathematical Representation	Students' verbal abilities have not been seen, because the purpose of the problem-solving process is not explained.

The results of student answers in table 1 are followed by the results of interviews to determine student learning habits. The results of the interviews are as follows:

P   : When you are facing the question in the form of narration, what should you do to answer the question?
S1   : As far as I know, the first steps are imagining then try to answer it Miss.
P   : How did you solve the problem?
S1   : What did you mean?
P   : How did you solve the problem? Did you use elimination or substitution?
S1   : Elimination, but I am not sure
P   : How could you get $x = 2$?
S1   : From $3x - x = 2x$
P   : When you drew the graphic, how could you draw it?
S1   : As we know that $x = 2$ and $y = 14$, then I gave the dash and gave it the shading like this.
P   : How can you manage your time to study in home by using online learning system?
S1   : Hehehe, I studied when the deadline came up Miss, and when I the teacher gave me homework, I asked my friend to teach me.

P   : I though that your teacher gave the task and also gave the the opportunities to ask if the instruction was not clear via WhatsApp, did not it?
S1   : WA. Yes Miss, I just followd up in the group, and never asked something.
P   : So, what did you do in your home when the online class began?
S1   : Because I am in home, sometimes I help my mom.
P   : Why did not you study or just ask to your teacher?
S1   : Miss, but I do not know what should I ask?

Based on the result of student's answer and interview, it represented that student 1 or (S1) did not try to understand the lesson material in the form of symbolic, verbal or visual. The less of student's understanding to represent the problem because student's learning habits which was not good enough and student spent the time just for another activity.

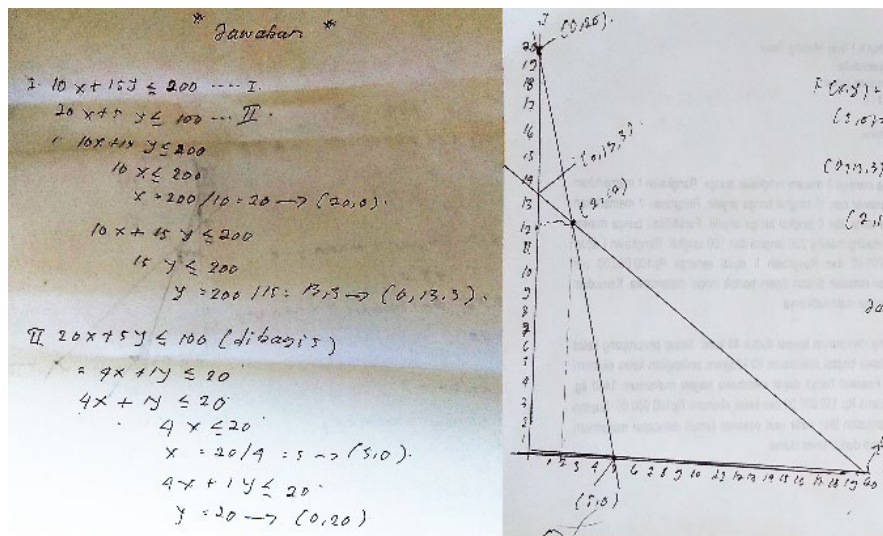In addition, the results of student answer sheets 2 or (S2) are shown in figure 4 below:

Figure 4. Student's (S2) answer sheet

The results of student answer sheets 2 or (S2) based on mathematical representation abilities are described in table 2 below:

Table 2. Mathematics Representation Ability by Students 2

Mathematical Representation Ability	Student Ability
Symbolic Mathematical Representation	The answers given by S2 to the mathematical model were not quite right, the students mentioned x as roses and y as carnations.
Verbal Mathematical Representation	The visual representation ability of students is able to draw graphs according to line equations 1 and 2, but the intersection point between line equations 1 and 2 is not precise, so the resulting graph is also not suitable.
Visual Mathematical Representation	The ability of students' verbal representation is not optimal, because there is no explanation of the mathematical model symbols and there is no explanation of the steps taken to solve the problem.

After analyzing the answers obtained as shown in table 2, then an interview was conducted with student 2 (S2) to ask about the results obtained and learning habits. Following are the results of student 2 (S2) interviews that have been conducted:
P   : In your opinion, is your answer correct?
S2   : Yes, it is, but I am not sure Miss, I do not know the graphic is correct or not.
P   : The intersection point from two line of equation I and II or (2,12) how could you get it?
S2   : I drew the dash and found $x = 2$ and $y = 12$.

P : So, in yur opinion is correct or not?
S2 : I worked it by my own understanding.
P : Actually, you can draw the dash as you did, but if the graphic has the same value, you can use the plot book. The graphic that was drew by you has irregular scheme, if you draw the scheme as you did it will be drawn uncorrect intersection point. You can use elimination and substitution to get intersection point correctly.
S2 : Okay Miss, I am sorry, I forget to do it
P : Then, how could you do mathematical modeling? Did you think that it was correct?
S2 : Yes, I did Miss. I got it by rose as x then Anyelir flower as y
P : Are you sure about that? Then how about in the next sentence, the price of the 1st series is Rp. 200.000,00 and for the 2nd series you sale it Rp. 100.000,00, could you explain it about that?
S2 : So, the correct pattern is 200.00 x + 100.000,00 y, is not it?
P : That's correct pattern, if you argued that rose as x then anyelir flower as y, it means 200.000 x + 100.000 y refers to x as the 1st series and y as the 2nd series.
S2 : Checking and understanding the question) Oh I see Miss, I am confused hehe
P : So, what is the correct modeling based on your understanding?
S2 : My unser is uncorrect Miss
P : Never mind, just keep analyzing it in detail for later. Discussing anout learning system, I want to know about your opinion related to online learning. How could you manage your time to study via online?
S2 : Actually, I prefer study in the class face to face rather than online learning. Because I can understand the lesson material easily. I just learnt to write my homework and sometimes searched the example on the internet, but sometime I did not undestand about the example.
P : Did you discuss the lesson material in your WhatsApp group?
S2 : Sometimes I am shy to ask about that in the group, I just followed up it.
P : Did you still follow up the discussion forum in WhatsApp group at morning or afternoon? Or did you do another activity?
S2 : Yes, I did. But sometimes just for several times because I am free at home

Regarding to student's opinion above, it can be known that student 2 was not goot enough at working the task, especially in symbolic, verbal or visual form. The learning activity which did at home via online learning did not use well by student 2. When the online class was started, student 2 searched the lesson material on the internet, she did not give her attention on online class. Moreover, student 2 did another activity.
In addition, the results of student answer sheets 3 or (S3) are shown in figure 5 below:
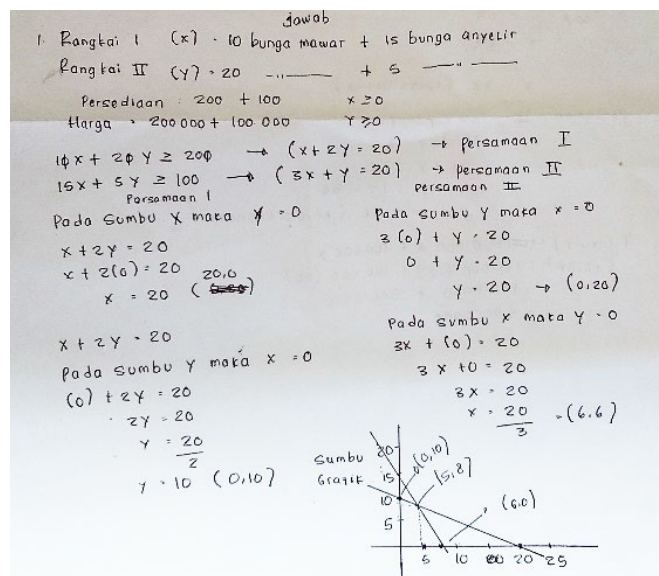

Figure 5. Student's (S3) answer sheet

The solution that has been done by S3 is based on the ability of mathematical representation as in table 3 as follows:

Table 3. Mathematics Representation Ability by Students 3

Mathematical Representation Ability	Student Ability
Symbolic Mathematical Representation	The solution that has been done by S3 in writing a mathematical model is less precise, namely the sign ($\geq$) in equations 1 and 2.
Verbal Mathematical Representation	The visual ability of students is able to describe the graph, but the search for the intersection point of the equations of lines 1 and 2 is not precise, so the resulting graphic image is also not suitable.
Visual Mathematical Representation	The verbal ability of student 3 already looks good.

The results of the students' answers that have been obtained are then followed by interviews with S3 students by asking about the results obtained and the learning habits carried out by S3 students. The result of student's interview as follows:

P : Do you think that your answer is correct?
S3 : I do not know, Miss.... hehehe
P : How could you get the sign greater than equal which is used to find the Ist and 2nd equation?
S3 : From this sentence Miss; "The stock of rose and anyelir flower is 200 footstalk and 100 footstalks".
P : Is it correct, if you used the less than equal sign?
S3 : Yes, maybe it is correct. I still do not understand about that especially in giving the equal sign Miss.
P : If we try to understand the real meaning of the question, we will find that each rose or anyelir flower is 200 footstalk and 100 footstalks. Thus, is it okay if we sell the rose more than 200 footstalk or anyelir flower more than footstalk?
S3 : No, it is uncorrect Miss.
P : So, what is your opinion about that?
S3 : My answer was not correct Miss, the signaling of greater to equal was not correct. The correct one is less than equal.
P : Then, how can you get the intersection point of the Ist and IInd equation or (5,8)?
S3 : I drew the dash based on my forecast. I thought that $x = 5$ then $y = 8$
P : Are you sure about that?
S3 : Yes, Iam. As far as I know thats the right way.
P : Actually, you can do the way as you did, but the graphic has distance in every formula, such as when you used plot book. Or, you can use elimination and substitution formula.
S3 : Okay Miss, I am sorry I forget about that
P : Discussing anout learning system, I want to know about your opinion related to online learning. How could you manage your time to study via online?
S3 : When I got homework via online, I tried to anwer the question by asking my friend or just looking for the answer on the internet.
P : Did you learn by yourself if your teacher gave you the task?
S3 : Yes Miss, and I was not focuss on the lesson material when my teacher delivered the lesson material via online.
P : How could it be?
S3 : Because sometimes I watch television, scrolling somethig on my phone or doing another activity not to focuss on the lesson materials.
P : So, what was the time your online class will be started? Then what is your learning habbit during study from home?
S3 : usually, I study while working the task. When I bored in studying, I stopped it then starting study again at night.
P : If you did not understand about the lesson material, did you ask to your teacher in WhatsApp group?
S3 : Yes, I did Miss, but sometimes I still do not understand about the lesson material. Learning process via WhatsApp was hard Miss. I prefer study face to face because I can understand the lesson matrial easily.

The result of interview of student 3 showed that student 3 still did not understand the concept in representing the problem in symbolic form and she could not draw the graphic well. Student 3 declared that the learning habits during pandemic was not good enough because online learning was not easy to understand the lesson material which was delivered by teacher. In addition, student 3 spent her time not to study but for doing another activity.

Regarding to the result of test and interview, it can be known that students' ability in mathematical representation was poor. Students was not good enough in giving symbolic mathematical modeling. Students also did not draw the correct

graphic. So that students have not been able to represent a problem in a symbolic and visual form well (Iskak et al., 2020).

Student 1 does not understand the criteria for mathematical representation ability because student 1 feels confused when asked about errors in processing symbolic representations, does not provide explanations in the problem solving process clearly, and draws graphs carelessly. Moreover, the student 2 already has the ability to represent both symbolically and visually, although it was not yet perfectly. In addition, student 3 has found the criteria of symbolic, visual and verbal representation, but she could not understand narration question well. The lack of mathematical representation skills possessed by students is also due to changing the learning habits became online learning which was not appropriate. In the reality, students did not study at home independently even though online learning already applied. All those problems because someone who did not have good at learning habit such as they did not want learning independently. The worst problem is students just studying in the short time before the exams or tests will be started. Attending school just for prestige, they did not have complete lesson materials, of course, they will not get the optimal learning outcome (Agustyaningrum & Suryantini, 2003).

5. Conclusion

Based on the findings above, it can be concluded that the students' mathematical representation ability is still low, this can be seen from the students' problem solving process that is not optimal. On the other hand, students' learning habits that have changed from face-to-face learning to online learning affect their learning abilities. The mathematical representation ability of student I still has errors in processing mathematical symbols, seems unable to make graphic images well, verbal representation skills are not visible and still have bad learning habits. Student 2's learning ability shows that he can provide problem patterns in the form of mathematical models and illustrate diagrams well, but in determining the intersection point between the first and second equations is still not right, students' verbal skills and online learning habits have not been used regularly. Student 3 gets an error in giving symbols in mathematical modeling but can explain the mistakes made, has not been able to represent the problem in graphic form well, has seen verbal ability in problem solving. In addition, student 3 applies regular learning habits. Some of them do not use their time to study, but sometimes they use their study time for other activities outside of online classes. The influence of online learning makes educators unable to fully control their students to learn, because those who can fully control the student learning process are their parents.

That case is not the appropriate reason reason to stop learninng system which used technological development. Technological development helped and controlled students to learn. One of technological development that can be used by students such as using zoom meetings application or other web meetings. In Indonesia the internet network disruption is a very crucial problem, if the signal is constrained, teachers or educators can provide the learning media that can be used by students independently which related to their character, such as learning modules. The existence of a learning module maybe can help students in carrying out the learning activities easily by providing students' problems contained in the module. However, the quality of learning activities at home will be more widely.

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