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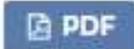


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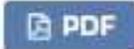
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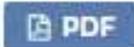
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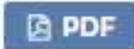
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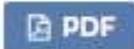
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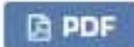
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Epistemological Obstacles in Solving Equation of Straight Line Problems

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Abstract. Epistemological obstacle is one of the learning obstacles that need enough attention in overcoming it, Epistemological obstacle is the learning barrier that occurs because of the limitations of the context possessed by the students. This study aims to analyze epistemological obstacle that occurs when students solve the problem on the topic of equation of straight line, the method in this research is qualitative descriptive involving 32 students in class 9th grade and the test instrument used is 4 problem description of equation of straight line, Result from research most students experience epistemological obstacle in solving straight-line equations, especially in determining the equation of lines if the gradient is unknown, this is because students only know the general form formula of straight-line equations only, by knowing the obstacle epistemology that happens is expected to help the teacher to make the design didactic material of a straight-line equation that corresponds to the epistemological obstacle that occurs.

1. Introduction

Mathematics is a subject that is avoided by many students because students consider it as a difficult and frightening subject, it causes the students' value about mathematics students is low. The average result of the National Exam of mathematics subjects in 2015 amounted to 56.28 decreased in 2016 by 6.04 points to 50.24 [1], this is so worrying, especially for mathematics teachers. Mathematics learning is developed in such a way so that students do not face any difficulty in understanding certain materials so that the learning objectives can be achieved, innovative learning models are applied in order to make students become happy with mathematics, In addition to the learning model used, need a study on the development of teaching materials used by teachers in learning, appropriate teaching materials can effectively overcome learning difficulties. The low quality of mathematics education is due to the obstacles in the learning process known as learning obstacle. In this case, teachers are required to be creative, for example ini developing teaching materials. [2],

Teachers's efforts in improving the quality of learning are through reflection on the relevance or the correlation between the design and the learning process. If the lessons developed are more focused on the achievement of the objectives, then the substance of evaluation also focus on the objectives, so the problems related to learning diversity, obstacles, and learning paths of students may not be the main substance of the evaluation [3], therefore the subject used by the teacher should be based on the students' need, each teaching material has its own characteristics based on the material to be discussed, the instructional materials should be based on some things that are learning barriers experienced by students and learning trajectory or learning path. Teaching materials are one component to support learning process in a didactic situation. A teacher should create an alternatives learning strategies in order to

anticipate the problem emerge during the learning process, which describes the existence of efforts to facilitate the learning trajectory of children's learning path [4].

Student learning obstacles are divided into three types: ontogeny obstacles associated with mental readiness of student learning, didactic obstacles caused by teaching process of the teacher, and epistemological barrier that is on students' knowledge which has limited application context [5]. The difficulties faced by students in learning are not the result of the students themselves, but can be derived from the way the teacher presents the material or teaching materials used during the learning process [6]

Focus of this studies is epistemological obtacles, this is because epistemological obtacles are the barriers that mostly experienced by students. Barriers are often experienced by learners when they are given problems in the form of questions. Problems that students often do during classroom lessons take place only identical problems, so that when the problem is changed a little they are not able or have difficulty in solving it, in previous research it is known that students experience epistemological obstacle on the matter of quadratic equations [7]. Epistemological inhibition has relevance to cognitive impediments, didactic barriers and ontogenetic constraints, The leap of information is an unfathomable acquisition of knowledge. If the information leap is constrained, epistemological constraints occur. Epistemological obstacles can lead to the stagnation of scientific knowledge, and even the decline of one's knowledge. [7] A straight-line equation is a material that must be mastered by students, this material is a prerequisite material before studying other materials such as matter of quadratic equations. The material of straight-line equations is a matter related to many branches in mathematics. The equations of straight lines are included in algebra, analysis and geometry. This material is also a prerequisite when studying mathematical material at higher levels, and also supports other materials such as statistics, as well as in other fields [8]. The equation of a straight line is one of the most complicated material, since it requires knowledge of Cartesian coordinates, linear equations of one variable, and straight line drawing skills in the Cartesian field, in addition to many straight-line equations that students must study [9] but in fact the ability of students in understanding this material is still low. As many as 60.3% of the total 38 students in one junior high school in Kota cimahi stated that the most elusive material is the equation of a straight line. therefore the researchers chose this material for further study.

From the above explanation, the researcher wanted to analyze the epistemological obtacles on the equation of straight line equation, by analyzing the epistemological obtacles that happened, it is expected that the teacher can develop the equation of straight line equation which is in accordance with student learning obstacles

2. Method

This research uses descriptive qualitative method, qualitative research method is chosen because this method can give more detail explanation about complex phenomenon which is difficult to be explained by quantitative method, Data was collected from student individual written test and interview about their difficulty. with a sample of 32 junior high school students of class 9, the test instrument in this study is a matter of description on the equation of straight line matter as much as 4 pieces of question. From the results of student work then taken some samples to be the epistemological obstacles that occur descriptively.

3. Result and Discussion

Here are four question that have been given to the students:

1. Among the equations below, which is a straight-line equation, explain your reasoning!

- a. $y = 5x$
- b. $y = x^2 - 3$
- c. $y = x$
- d. $x^2 + y^2 = 0$

Figure 1. Equation of Straight Line Problems

the question was done by 32 students, here presents the recapitulation of students who experience epistemological obstacles in solving the problem:

Table 1. The Recapitulation of Students Who Experience Epistemological Obstacle

Question Number	Indicator of Question	Number of students who encounter Epistemological obstacles
1	Identify the equation of a straight line of some given equation	6
2	Determining the line equation of two points is known	18
3	Determine the position of two lines	16
4	Draw a straight line equation	7

From Table 1 it can be seen that most epistemological obstacle faced by students in the problem of straight-line equation is in question number 2 which determines the equation of the straight line of the two known points, but students also still face many epistemological obstacles, from the results of the student answers the researchers took some samples to be analysis for each question, here are the analysis: In Problem 1 the indicator identifies the straight-line equation of some equations given by 6 students experiencing epistemological obstacle, following one sample of 6 students who experienced it:

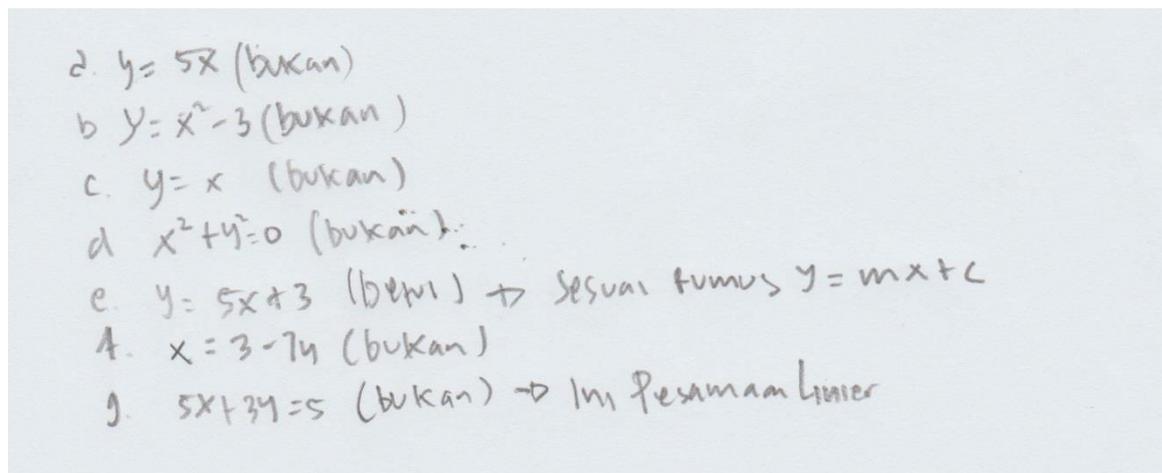


Figure 2. Epistemological Obstacle in Problem number 1

In that question the students are asked to determine from the seven equations that exist, which one is the equation of straight line, the student replied that the equation of a straight line is only "e" with the reason, the form is in accordance with the general form of the straight-line equation i.e. $y = mx + c$, whereas the equations a, c, f and g are equations of straight line as well, its a modified form, it is clear that student experiences the limitations of context concerning the form of a straight-line equation, they assume that the general form of the straight-line equation always be in the form $y = mx + c$, this is in line with previous research that the obstacles in changing the form of this straight-line equation are due to students' incomprehension and see only a similar example [10]. Next the researchers took samples epistemological obstacles on the number 2 problem with the indicators determine the equation of a straight line of two known points, it turns out in this problem students face epistemological obstacle, that is as many as 18 students experience it, the researchers took 1 sample of student work, the following analysis:

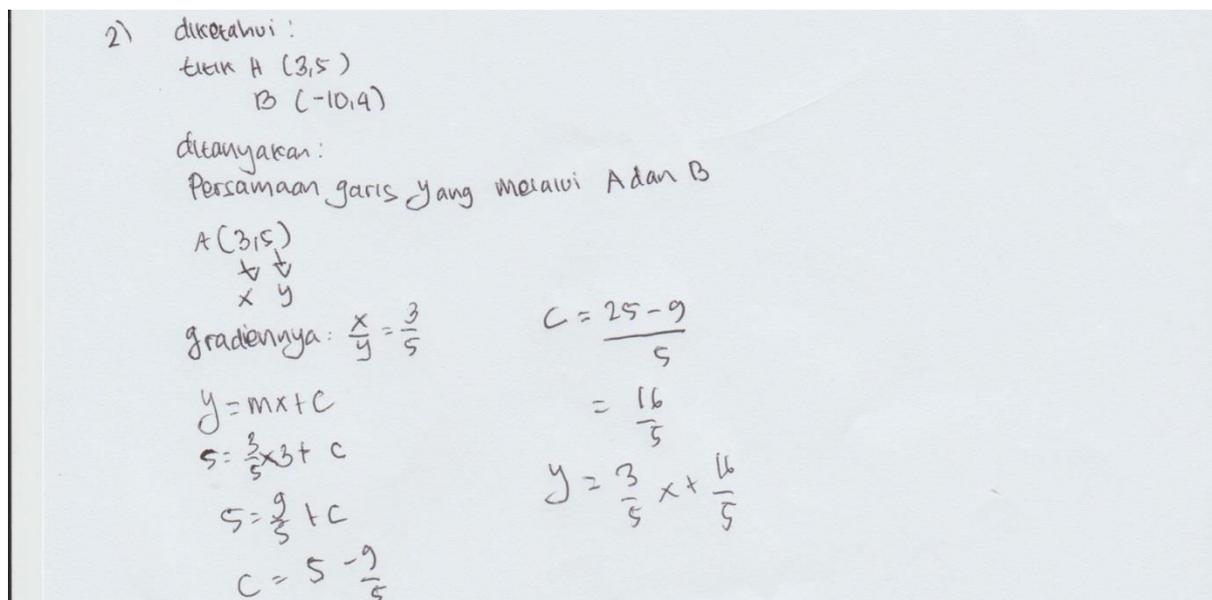
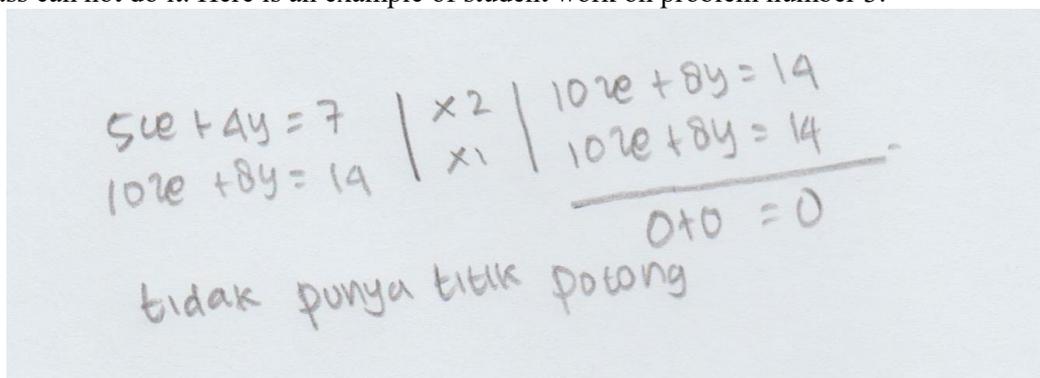


Figure 3. Epistemological Obstacle in Problem number 2

In question number 2 the student give incorrect answer, they determine the first gradient with the wrong formula, then they look for the value of C after that they substitute the gradient and point on the general equation, it shows student has limited context about gradient, but to finish it we can directly determine by the equation of a straight line through two points, or determine the gradient

first. In solving the equation of a straight line that is passing through two points Students often seem to put more effort in calculation and correspondingly less to making sense of the problems [11]. Next, the researcher took a sample of the students' work with epistemological obstacles on number 3 with indicators determining the position of two lines, as many as 16 students from 32 students experiencing this epistemological obstacle, this number including many categories because half of the students of one class can not do it. Here is an example of student work on problem number 3:



$$\begin{array}{r|l}
 5x + 4y = 7 & \times 2 \\
 10x + 8y = 14 & \times 1 \\
 \hline
 10x + 8y = 14 & \\
 10x + 8y = 14 & \\
 \hline
 0 + 0 = 0 &
 \end{array}$$

tidak punya titik potong

Figure 4. Epistemological Obstacle in Problem number 3

In question number 3 researchers want to know how far students understand about the position of the line, the line $5x + 4y = 7$ and the line $10x + 8y = 14$ is two lines that coincide each other so that there is a lot of cut points that shows infinity number, but in Figure 4 the student responds that the two lines do not have a cut point because when they eliminate the x or y they obtain both sides if minus all will be gone. It is clear that these students have limited context on the position of two mutually overlapping lines, that the lines are not only intersecting, but some are parallel, perpendicular to each other and coincide. And if we want to see the position of two lines we can draw it first in the field of Cartesians. Drawing lines in Cartesian diagram, it will apply the definition of geometry. The lines on the plane definitely meet exactly one state ie parallel or crossed. Intersect alone will be said to be perpendicular or intersect. The line is said to be parallel or perpendicular can be seen through the slope. If both lines have the same slope then the two lines are said to be parallel [12].

In question number 4 with the indicator of drawing a straight line equation in Cartesian field there are 7 students dri 32 students who experience epistemological obstacles, although the numbers are fewer but this should still be the attention of the teacher, because in the equation of straight line the students should be able to describe it in the field Cartesians. Here is a sample of students who experienced epistemological obstacle on problem number 4:

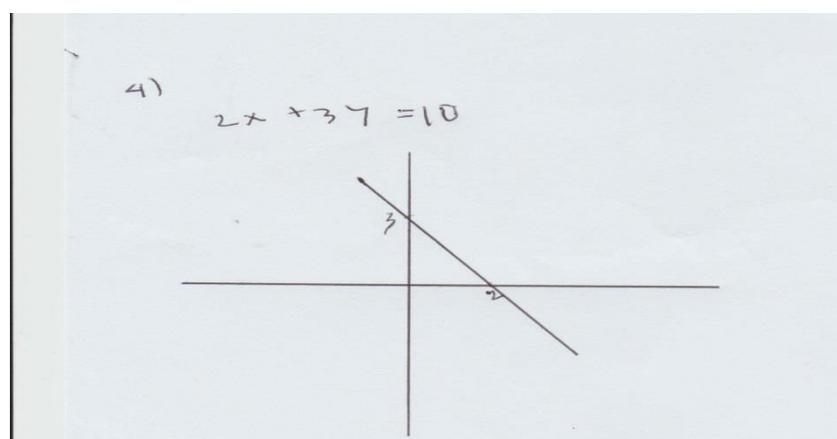


Figure 5. Epistemological Obstacle in Problem number 4

Students are asked to draw a line equation $2x + 3y = 10$, but in Figure 5 the students just draw a line equation with the intersection on the x axis (2.0) and y (0.3), When presenting a straight-line equation with a graph, points in the coordinate plane. This ability is part of spatial abilities. The existence of the position on the left-right or top-down of the point O (0,0), involving negative and positive integers causes the students this concept becomes more difficult again. Then, to find out the mindset of students is further conducted interviews then the researcher gives another problem that he is asked to describe the equation of line $y = 2x + 1$, surprisingly, the student can draw the gais equation well, it determines the intersection point with the x and y axis correctly, he reason not know how determine the intersection with the x and y axes if the form is not $y = mx + c$, this student experiences the context of drawing a straight-line equation if the form is not $y = mx + c$

Based on the explanation above, its proves that Epistemological obstacle occurs, due to lack of understanding. By understanding the concepts in mathematics, includig but not limited to rules, ways, or theorems, will make it easier for students to apply them. One form of application of rules or theorems in mathematics is to solve the problem [8]. the concept of linear function is initially based on mastering the representations of function. Students should know the three main representations for the concept of function: algebraic expression, tabular and graphic representation. This means that as students start to study linear function, they have achieved the first level- Dependent Relationship already [13]. With the discovery of this epistemological obstacles, teachers can facilitate students in minimizing and even overcoming the obstacle epistemological that occurs in straight-line equations.

4. Conclusion

Based on data analysis, it can be concluded that many students experience epistemological obstacles in working on the problem of straight line equation, at most in determining the equation of straight line if known 2 points and gradient is not known. It needs further research whether the obstacle epistemological is associated with ontogenic obstacles and didactical obstacles. It is hoped that this study will be a preliminary study in developing a didactic design that is appropriate to the learning obstacles experienced by students.

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