Student Learning Obstacles on Sets Concept

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Abstract. Set is one of the main subjects in mathematics and is a material that
raises quite a lot of learning obstacles for students. This study aims to identify
the learning obstacles that arise and reveal the factors that cause the emergence
of these obstacles. This research is a descriptive qualitative research. The partic-
ipants involved in this study were 32 8th grade junior high school students who
had studied set material. The data collection technique in this research is to give
test questions consisting of four questions. Then the author analyzed each stu-
dent's answer and then conducted interviews with four students who the author
considered could represent other students in this study to confirm the students'
answers to the test questions that had been given. In addition to giving tests and
conducting interviews, the author also made observations when students took the
test. Based on the results and discussion, it was found that some students experi-
enced epistemological obstacles in working on questions about understanding the
concept of set material, which led to incomplete student learning. This can be
seen from the difficulties experienced by students, not because they do not have
knowledge but because of the inaccurate context of knowledge used by students
in solving the problems they face.

Keywords: Ontogenical obstacle, didactical obstacle, epistemological obstacle.

1   Introduction

Please The learning process in the classroom is inseparable from learning obstacles.
The cause of the emergence of learning obstacles is due to several things related to
student readiness to start learning (ontogenetic learning obstacles), limited understand-
ing of concepts owned by students (epistemological learning obstacles), as well as
stages and sequences in delivering material that result in inappropriate conceptions
owned by stu- dents (didactic learning obstacles) [1]. Especially in mathematics learn-
ing, mathemat- ics is not only presented as subject matter that contains mathematical
objects such as definitions, theorems, proofs, problems, and solutions, but mathematics
must also be presented as a conceptual tool to build these mathematical objects [2]. So
that if this learning obstacle is not overcome properly, then students tend to make less

meaning of the material being studied because they are hindered by the learning obstacles that arise.

Set material is one of the important materials for students to understand because the set is a fundamental object in mathematics, but this material is also one of the materials that often provide learning obstacles for students [3]. Some of these learning obstacles are caused by the teacher's misunderstanding of the mathematical concept of sets, namely that a set is considered to consist of more than one element; the concept of an empty set is rejected; and two sets are the same if they contain the same number of elements [4]. In a different study, it was shown that students had no difficulty in identifying the set members of the set $S = \{1,2,17,69\}$, but students had difficulty identifying the set members of $A = \{5,7,\{5\},\{5,7,\{7\}\}\}$[5]. Furthermore, in Bingolbali, Demin & Monaghan found a didactic phenomenon on the concept of sets, which shows that in the curriculum, school mathematics textbooks, learning by teachers, as well as the understanding of students and students, the set is always interpreted as a collection that contains elements that have the same properties, while the set that contains elements with uncommon properties is not considered a set [6].

Based on the description above, in this study, the authors want to focus on identifying student learning obstacles based on ontogenic learning obstacles, didactic learning ob- stacles, and epistemological learning obstacles, and they will also explore the causes of the emergence of these learning obstacles.

2   Method

This research uses a descriptive-qualitative approach. Qualitative research means that the researcher has an active role in the process of data collection and processing and determines the entire scenario of the research [7]. Researchers have a role to play in focusing on research on data sources, data collection, data analysis, and drawing conclusions from their findings in the field. The participants in this study were 32 8th grade students in junior high school who had learned the concept of set. In the early stages of the research, the author developed four description questions related to the concept of sets. The description problem was chosen because the description test can measure students' mental processes in pouring ideas into answers. After the preparation was done, the problems were given to secondary school students. Furthermore, the author conducted interviews to get more information related to student learning obstacles.

3   Result and Discussion

The participants in this study were 32 8th grade students in one of the junior high schools in Karawang Regency. Researchers gave four items of description questions designed to find out students' learning obstacles to set material.

3.1 Learning obstacles on question number 1

In problem number 1, researchers gave questions related to the grouping of sets, not sets. In question number 1, the majority of students can already distinguish between a set and not a set. It's just that when asked what a set is, the majority of students cannot explain in their own language what is meant by a set.

3.2 Student learning obstacles in question number 2

In problem number 2, researchers gave questions that aimed to find out students' learning obstacles related to the set of parts. Based on the data obtained, almost all students were unable to answer question number 2 correctly, but some students were able to restate the problem into set form even though the student's answer was not correct. This is because students do not understand the concept of sets and the properties of set relations. This can be seen in the Fig.1.
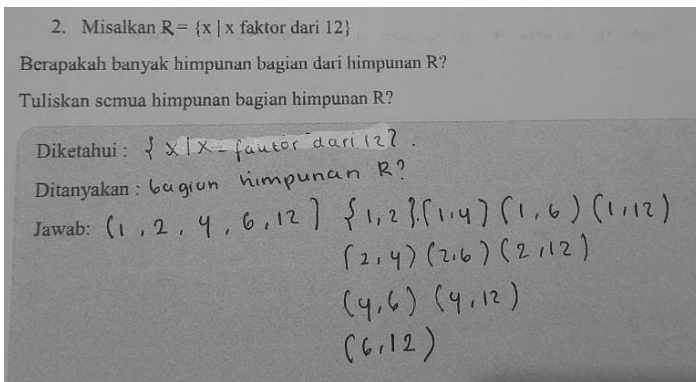

Fig. 1. Answer number 2

Based on the picture above, it can be seen that students write down what is known by making statements about the problem in set form. Furthermore, students write the answer to the question about the set of parts. However, in the known part, students do not recheck the answers that have been written. So that in the form of the set of factors of 12 students only write {1,2,4,6,12} not with 3, even though 3 is included in the factor of 12. Students also make procedural errors, where students immediately write {1,2,}, not with { }, {1}, {2}, and so on. This is because students do not fully understand the concept of a set of parts. In problem number 2, students still experience conceptual and procedural errors. Where students only receive part of the context of the set of parts material. Errors in understanding the problem can be seen from the results of student answers when students do not write correctly what is known from the problem and do not complete the answer according to the steps [8]. In addition, the factor that causes errors is students' carelessness when working on problems, and students do not check the answers they have written [9].

3.3   Student learning obstacles on question number 3

Based on the data obtained, almost all students were unable to answer question number 3 correctly, but some students were able to restate the question into set form even though the student's answer was not correct. This is because students have limitations in understanding the concept of sets and the properties of set operations.
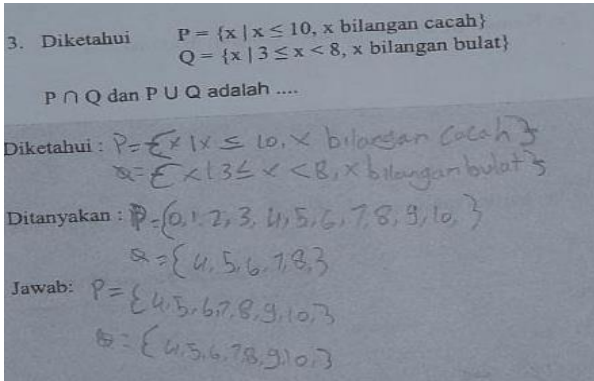

Fig. 2. Answer number 3

Based on the Fig. 2, the student seems to write what is known by making statements in the problem into set form. However, the student has not correctly answered the question regarding the set intersection and the combined set. Students have been able to understand the set form correctly, but they have not understood the set members. As seen in the student's answer, students do not understand the less than equal sign ($\leq$), so in set Q, students do not write 3 as a member. Meanwhile, in the answer regarding the problem of set intersection and the combined set, students answered incorrectly, or it could be said that students were parroting the answer because they did not understand the concept of the material correctly. Students do not understand the sub-material of the set, be it set relations or set operations, but the subject already understands the definition and form of the set.

3.4   Student learning obstacles on question number 4

Based on the data obtained, almost all students can answer question number 4 correctly, but some students cannot solve the problem correctly. This is because some students have epistemological obstacles to understanding the concept of sets and the properties of set operations.

Fig. 3. Answer number 4

In the Fig. 3, students are seen writing what is known by making data, namely, 18 students like math, 10 students like biology, and 8 students like both. Furthermore, students write the answer to the question, which is (18+10) - 8 = 20 students. In the known part, students did not write the equation first and did not write the problem in- formation into a set form such as a Venn diagram or set symbol. Thus, a procedural error occurred. Where students should have written the equation first, namely students who like math = A and students who like biology = B, then write n(A) = 18, n(B) = 10 dan (A ∩ B) = 8. And write the solution with n(S) = (n(A) + n(B)) - (A ∩ B). Students still experience conceptual errors. Students are still wrong in applying the concepts in the set material. Students do not do the solution according to the set procedure. So it appears that students work on problems because they guess and use reasoning without knowing the concept of the set.

Based on the students' answers, it can be seen that some students have epistemological obstacles when working on questions about understanding the concept of set material, causing incomplete student learning. Brousseau introduced a way of looking at learning difficulties with the idea of epistemological obstacles. This idea reveals that the diffi- culties experienced by students are not because they do not have knowledge but because of the inaccuracy of the context of knowledge that students use in solving the problems they face [10]. This is in accordance with the view of constructivism that the process of building student knowledge is carried out actively based on students' experiences with prior knowledge.

Furthermore, Laily and Puspasari stated that learning difficulties experienced by students are caused by (1) a lack of understanding of the mathematical concepts that have been learned; (2) a failure to link the mathematical concepts to be learned with previously known concepts; (3) the habit of quickly forgetting mathematical concepts that have not been understood; and (4) the habit of learning from examples of problems given by the teacher or from books that he learns instead of from books that he learns [8].

4   Conclusion

Based on the results and discussion, it was found that some students have epistemological obstacles in working on problems of understanding the concept of sets material, which causes incomplete student learning. This can be seen from the difficulties experienced by students, not because they do not have knowledge but because of the inaccurate context of knowledge used by students in solving the problems they face.

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