Students’ ontogenic obstacle on the topic of triangle and quadrilateral

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Abstract. This research based on the students’ difficulty in solving problem in triangle and quadrilateral topic. The difficulties can be identified from the mistakes made by students when solving triangle and quadrilateral problems. It can be caused because of learning obstacle experienced by the students. The learning obstacle which was described on this research is only focused on ontogenic obstacle. The purpose of this research is to identify the ontogenic obstacle based on the mistakes of the students in topic of triangle and quadrilateral. This research used a qualitative approach. The research was conducted to 25 grade VII students in one of junior high schools in Sumedang and a teacher as participants. Furthermore, the students answered 5 questions in test given and then the researcher interviewed 3 students based on their answers on the test. The researcher analysed the data of this research by using triangulation method from data of students’ answer on the test given, also interview of the teacher and the students. The result of this research showed that the researcher identified the ontogenic obstacles experienced by the students on topic of triangle and quadrilateral. The first ontogenic obstacle is psychological ontogenic obstacle where the student were less interested to the learning process of triangle and quadrilateral topic. The second ontogenic obstacle is instrumental ontogenic obstacle where the student were mistaken to recognize the guideline line on the picture given, and the last ontogenic obstacle is conceptual ontogenic obstacle where the student did not understand the topic of quadrilateral well based on the learning experience of the student in measuring length and area.

1. Introduction
As we know that the learning process at the class sometimes does not match with the teacher’s expectations. When the teacher gave a problem for the students, they cannot explain and solve it properly. It indicated that mental action did not happened on learning process. It can be seen from inability of students to explain relation among mental objects relating to the problem [1]. Learning phenomenon often occurring today is learning process that is not contextual with condition of students, and it can impact to way’s thinking which is imitative as pattern of students’ thinking [2]. Basically the formation of a knowledge occurs extremely complex through the subsystem of interaction namely teachers, students, and knowledge systems [3].

Preparation on learning is the crucial stage on learning which must be considered by teacher. The teacher requires to master the process of before, during, and after learning to create meaningful learning[4]. In the learning process of mathematics, many students do mistakes which is caused by
obstacles during the learning process. While many teachers seemed to let the students always do the similar mistakes repeatedly. Certainly it can be a problem in the learning process. Efforts to overcome the learning obstacle in mathematics learning is rarely or never conducted. When the teachers do not anticipate this problem, then the students may always get a trouble during the learning process in the class. Teacher’s ability in identifying and analysing students’ mistakes in the learning process is one of the teacher’s abilities on metapedadidaktik [1]. Not all learning obstacles in the learning process can be overcome because each student has different learning obstacles [5]. However, the teacher must be able to identify and anticipate them as didactical and pedagogical anticipation [1].

Suryadi stated that basically mathematics learning is related to three important aspects, namely the teacher, the students, and the material. If the relation of that three aspects occurs a gap, then it can be a base of disorientation in mathematics learning [6,7]. Brousseau defined three categories of learning obstacles that experienced by students, namely epistemological obstacle, ontogenic obstacle, and didactical obstacles. Epistemological obstacle is learning obstacle which occurs because of limited understanding of students, ontogenic obstacle is learning obstacle which occurs because of the readiness and maturity of student, and didactical obstacles is learning obstacle which occurs because of the stages and sequence of presentation of material [3]. On this research, the researcher just focus to discuss ontogenic obstacles only. Furthermore, Suryadi explained that there are three types of ontogenic obstacle, those are psychological ontogenic obstacle, instrumental ontogenic obstacle, and conceptual ontogenic obstacle [8]. The first type is psychological ontogenic obstacle. It is related to psychological aspect of the students such as motivation and interest to the particular topic. The second type is instrumental ontogenic obstacle which is related to technical process in learning. The third type is conceptual ontogenic obstacle which is related to level of concept in learning process which does not correspond to the students’ experience in learning.

In the learning process of mathematics, geometry plays a crucial role. Geometry is one of the scopes in mathematics where it allows to connect mathematical topics and daily life [9]. Concepts in geometry can train the creativity of students in solving a problem relating to mathematics. Dan and Xie stated that the purposes of learning geometry namely to develop the ability of creative thinking, to develop intuition, to teach knowledge, and to teach how to read and interpret mathematical arguments [10]. In fact, students’ achievement in geometry is still extremely low as seen on Lutfi’s research where students’ level of geometrical thinking was still level 2 [11].

Triangle and quadrilateral are one of topics in geometry which is difficult to learn by students. Based on the research results from Indraswari that the difficulties experienced by students in completing questions about triangle and quadrilateral were in the analysis, evaluation, and creating stage [12]. Those difficulties were caused by several factors namely students were not accustomed with the problems related to triangle and quadrilateral, students were not interested to topic of triangle and quadrilateral, and students tended to depend on teacher's help [12].

Based on the description above, this research aims to identify students’ learning obstacle especially ontogenic obstacle. Through this research, the researcher was able to obtain helpful information about students’ learning obstacle, and it can be anticipated later by the teacher.

2. Methods
This research used qualitative approach with triangulation method. Participants in this research was 25 grade VII students in one of junior high schools in Sumedang. The researcher gave a written test of triangle and quadrilateral which consisted of 5 questions. To adjust them with the purpose of this research, the researcher only discussed 3 questions. All students who participated on this research have learned the topic of triangle and quadrilateral. Each student was given 90 minutes to finish the written test. After the researcher obtained the students’ answer, the researcher analysed them to identify the students’ mistakes. Furthermore the researcher conducted interview to some students to get more information regarding ontogenic obstacle experienced by students. The last stage was the researcher analysed all data of this research by using triangulation method.
3. Result and Discussion
The results of this research was described based on students’ answer. Researcher found three types of ontogenic obstacle applying the concept of solving triangle and quadrilateral problems. They were identified from the students’ answer and also students’ interview to confirm the mistakes they done.

3.1 Psychological ontogenic obstacle
Psychological ontogenic obstacle is related to psychology factor of students. It can be seen on how the student answer the question number two. Sample of question number two was “The circumference of a rectangle is 240 cm. If the ratio between length and width is 7: 5, determine the width?”.

Based on student’s answer on Figure 1, the researcher found that the answered the question only with the numbers known on the test. Then the student do algebra operation incorrectly so that the student did mistake on the test.

![Figure 1. Student’s answer in question number two.](image)

To deepen the student’s mistake the researcher interviewed the student in-depth interview. Based on the student’s interview the researcher found that the student were less interested to the learning process of triangle and quadrilateral topic. The reason of student was he did not like to learn mathematics long ago because the learning process was boring. The student thought that there was no a new thing learned from that topic. Here the researcher analysed that no anticipations which conducted by the teacher to the student’s problem. That finding can be a psychological ontogenic obstacle which caused the student’s difficulty. Lack of motivation provided by the teacher can result in the student not ready to learn.

3.2 Instrumental ontogenic obstacle
Technical difficulties can also be an ontogenic obstacle. They were identified by analysing students’ answer. Figure 2 showed the question number one where the student gave the incorrect answer.

![Figure 2. Question number one.](image)
Based on the student’s answer in Figure 3, it can be seen that the student gave two answers for the question. The student assumed that there were 2 triangles on the question so she combined the triangles to solve the problem given on the test.

In the interview of the student, the researcher knew that the student thought that the guideline line on the picture as side of the second triangle. The student were mistaken to recognize the line of base and height on the picture given. Consequently, the student added up two areas of the triangle. This indicated that the student did not mastered the concept regarding base and height on the triangle. Even though the base is always perpendicular to the height [13]. After the researcher analysed, the researcher found that this mistake was caused because of technical error which is done by the student. That mistake is related to ontogenetic obstacle experienced by the student. This type is instrumental ontogenic obstacle. This may seem trivial but it can cause the difficulties for the students if it is not anticipated by the teacher.

3.3 Conceptual ontogenic obstacle

One of the questions to identify the student’s mistake because of conceptual ontogenic obstacle is question number five. It was showed on Figure 4.

Student’s answer on Figure 5 showed that the student procedurally understood how to determine the shaded area. The student separated part by part of the shaded area. Therefore the student could choose the initial step to determine the shaded area. However the student was not able to give the correct answer for that question.
Based on the student’s answer, the researcher identified that the student was not able to interpret the picture on the test properly. Therefore the student was not able to give the correct answer. The student was not able to determine the length and width of the shaded part. In consequence, when the student calculated the combined area of the shaded part on the picture, the student got the incorrect answer. This mistake occurred because the student had difficulty solving the test. When the researcher conducted interview to the student, the researcher found that the student did not understand the topic of quadrilateral well. In addition, learning experience of the student toward the previous concept was still lacking. Even though learning experience and knowledge of the student can create a good learning process until it obtain particular concept [14]. That difficulty is classified as conceptual ontogenic obstacle. Some studies on learning process on mathematics related to measurement topic also stated that the students not only have difficulties understanding concept of volume but also on topic regarding measuring length and area [15].

4. Conclusion
Based on the findings of this research, the researcher concluded that there were still mistakes of students in solving the written test of triangle and quadrilateral. Those mistakes of students occurred because they had trouble answering the each question on the test given. Consequently, the answers given by students was incorrect. The researcher found that the students’ difficulties were caused by ontogenic obstacle, namely psychological ontogenic obstacle where the student were less interested to the learning process of triangle and quadrilateral topic, instrumental ontogenic obstacle where the student were mistaken to recognize the guideline line on the picture given, and conceptual ontogenic obstacle where the student did not understand the topic of quadrilateral well based on the learning experience of the student in measuring length and area. All of that obstacles are related to the students’ readiness in learning.

5. References
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