The analysis of the mathematics concept comprehension of senior high school student on dynamic fluid material

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Abstract. This study purposes to describe and analyse the students' concept understanding of dynamic fluid. The subjects of this research are 10 students of senior high school. The data collected finished the essay test that consists of 5 questions have been adapted to the indicators of learning. The data of this research is analysed using descriptive-qualitative approach by referring of the student's argumentations about their answer from the questions that given. The results showed that students still have incorrect understanding the concept of dynamic fluids, especially on the Bernoulli’s principle and its application. Based on the results of this research, the teachers should emphasize the concept understanding of the students therefore the students don not only understand the physics concept in mathematical form.

1. Introduction

The study of physics is focused on the understanding than the remembrance since the materials of physics are not just about concept but experiment, calculation, and graph. The students are not only demanded to comprehend the materials but also the application and the implementation in the real life. Comprehension is an ability to get or understand a purpose of a material [1]. The comprehension of concept in physics is essential and performed with the students’ ability to translate, interpret, and extrapolation.

Based on the fact, the students still get difficulties in comprehending the materials taught. They believe that physics should use some representations such as concept, equation, calculation, graph, and experiment. Hence, they regard that physics is complicated [2]. Their failure in solving the physical problems as they don’t use the owned fundamental. One of the problems that causes the students have a difficulty is the weakness of the data structure that is used to explain a phenomenon. The concept of comprehension is a basic of important factors for the students to study successfully [3]. The importance of the concept comprehension is a basic step for the students to comprehend the physics concept well [4]. By comprehending this concept, the students are expected to solve not only the physical problems but also the problems in life [5].

The materials of physics need to be composed more interestingly [6], not only stick out the concept comprehension but the students are also guided to comprehend the application and implementation in the real life. Therefore, the students are able to increase the concept comprehension in solving the problems. Some researches prove that the students have the concept comprehend to change the students’ concept [7], it’s because, when the students build their concept comprehension, they can construct their knowledge and decide a good problem solving [8].
The learning process that makes the students develop the concept can increase the concept comprehension of the students and improve the students’ way of thinking [9]. To increase the students’ concept comprehension, the knowledge which has been had by the students must be rebuilt in science [10] as its often found that the students’ knowledge is not accordance with science [11]. To understand how much the students comprehend the concept, essay is needed to be developed therefore the students can explain the answer clearly and sequent according with the students’ concept comprehension. This article is going to discuss the students’ concept comprehension and the improvement of the students’ concept comprehension through questions that have been developed in the materials of dynamic fluid.

2. Research method

This research is a qualitative research that uses the facts as the data. This research uses qualitative descriptive approach. There are ten correspondents in this research. The correspondents are categorized and based on the students’ cognitive comprehension: high, medium, and low. The correspondents are given five questions (essay) related to their comprehension of the dynamic fluid concept owned by the students.

3. Result and discussion

3.1. Analysing the concept of continuity

Question
A bricklayer pours 20 litres into a bucket from a crane. The diameter of the crane is 2 cm² and the velocity of water in a pipe is 10 m/s. Determine the time needed to fill the bucket!

The student’s answer

![Figure 1. Student’s answer for the concept of continuity.](image)

Based on the analysis on the students’ answer about the continuity concept (Figure 1), on the question number 1 and 2, it is found that there are many students who still do some mistakes in answering the question. It’s just like the research that has been done that the students got difficulties in understanding the concept of dynamic fluid on the material of continuity [4]. In answering the question, the students just put the number in the equation without observing the measurement. To calculate the debt, it uses $Q = \frac{V}{t}$. On the measurement V, most of the students wrote that V is the velocity. The fact, V here is Volume of liquid. It shows the process of learning physics still uses memorizing method [12], that is the formulas to be memorized. The students don’t also consider the purpose [13]. Based on the interview with the students, there are some mistakes which cause the students give the wrong answers. Some of the mistakes are that the students still get confused with the material of dynamic fluid, they don’t pay attention to the teacher when having teaching – learning process, and they just depend on their classmate’s answers. Therefore, they get difficulty to understand and master the material of dynamic fluid.
3.2. Analysing Bernoulli’s Base
Question
A pipe to flow water is put on the wall like in Figure 2. The ratio of the longitudinal section of a big pipe and small pipe is 4:1.

The velocity of water in the big pipe is 36 km/h with the pressure $9.1 \times 10^5$ Pa. Determine the pressure in the small pipe!

The student’s answer

Based on the analysis of the students’ answer on the concept of Bernoulli’s base (Figure 3), there are still many students giving a wrong answer for question number four. It’s just like the research that has been done that the students got difficulties in understanding the concept of dynamic fluid on the Bernoulli’s base [4]. In answering the question, the students just put the number in the equation without observing the measurement. In Bernoulli’s equation, $P_1 + \frac{1}{2} \rho v_1^2 + \rho h_1 = P_2 + \frac{1}{2} \rho v_2^2 + \rho h_2$. The students write that measurement for $h_2$ is 4 metre. The fact, it’s the height of the small pipe from the floor not the height between the big and small pipe. The students did this mistake because they lack of attention in the teacher’s explanation and they just depend on their classmate’s answers.
3.3 Analysis on the Bernoulli’s Base Application

Question
A tank with water 1.05 meter high and put on the height of 1.00 metre above the surface as seen in Figure 4. It has a small hole on the wall so that the water sprays horizontally.

![Figure 4. A tank with water.](image)

If the height of the small hole is 25 cm above the tank, determine the distance of the water spray from the hole!

The student’s answer

![Figure 5. Student’s answer for the question number 3.](image)

Based on the analysis on the students’ answer about the continuity concept, on the question number 3 (Figure 5), it is found that a lot of students who don’t understand the basic concept of Bernoulli’s base. There are many students who still do some mistakes in answering the question. It’s just like the research that has been done that the students got difficulties in understanding the concept of dynamic fluid on the material of continuity [4]. In answering the question, the students just put the number in the equation without observing the purpose of the measurement. The calculation of the horizontal distance of the water spray is the application of the Bernoulli’s equation. Therefore, if the students don’t understand the concept of Bernoulli’s base, they will get difficulties in answering the question. From Bernoulli’s equation, it results the equation to calculate the horizontal distance of the water spray, \( x = 2\sqrt{Hh} \), \( H \) is the height of the hole to the ground and \( h \) is the height of the hole to the water surface. The students consider that \( H \) is the table’s height. It shows the process of learning physics still uses memorizing method [12], that is the formulas to be memorized. The students don’t also consider the purpose [13].
The students’ mistake in answering the questions is also because they don’t pay attention when their teacher gives an explanation.

4. Conclusion
Based on the result of the research that has been explained by the writer above, it can be concluded that:
1. The students get the difficulties still in comprehending the concept of dynamic fluid especially the concept of continuity and Bernoulli’s base with the application.
2. The students lack of paying attention on the teacher’s explanation in teaching-learning process
3. The study of physics is only presented with the formulas without knowing the purpose.
4. There are still many students who lack of self-confidence, so that they usually give the same answer with their classmates’ thought they know the answer is wrong.

Acknowledgment
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