Student Oriented Learning In Floating and Drowning Concept

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Abstract. Teaching is a teacher’s daily job. Nevertheless, it turns out that teaching students about how they should study is not easy. This research is included as Research and Development—also known as RnD—which aims to give an actual example of how to teach and to floating and drowned concept in a simple way through Curriculum 2013. The result of the research, which is a student-oriented learning design and learning structure which in turn is an implementation of scientific approach, is the output resulted from a long term study, development and experience obtained by the writer team through teaching and training a number of supervisors, school principals, and teachers in various areas of Indonesia. The responses for this teaching model obtained from the teachers have been very positive, whereby 95% teachers claimed that they are very interested in the design, and only 5% claimed that they are mildly interested. This thus indicates that this teaching model can become a model to be referred to in teaching using scientific approach in Curriculum 2013.

Keyword: Oriented learning, Floating and Drowning Concept.

1. Introduction

Scientific approach makes use of discovery learning. Discovery learning itself is a teaching model which involves the students’ ability to look for and to find a thing, a human, or an event systematically, critically, logically and analytically by themselves, so that they are able to formulate their own discovery confidently [1]. Furthermore, Ismayati [2] mentions that during the teaching and learning process, the teacher should assist the students to be actively involved in the searching of concepts, principles, and facts for themselves, instead of lecturing and controlling the class (teacher oriented). This way, the students will be able to build their own knowledge on the matter.

The process behind floating and sinking is a quite difficult matter to be understood for most people, especially for the students who are still living in a concrete world. When asked about how things can float or sink, most people will answer that if the density of the fluid is larger than that of the item, the item will float \( (\rho_{\text{fluid}} > \rho_{\text{item}}) \), and if it is the other way around \( (\rho_{\text{fluid}} < \rho_{\text{item}}) \), the item will sink. However, when asked to explain the topic and relate it to real life condition, students are likely to have a trouble in explaining it. This is because the concept of density itself is abstract, which is certainly not suitable for teaching process which stems from Curriculum 2013. Thus, here the teacher is challenged to be able to make the students able to understand the concept given, based on their development. To answer that challenge, it is very important that a teacher teaches science through scientific procedure. Scientific procedure is actually the foundation of scientific approach in Curriculum 2013. One of the activities that can be used by the teacher is experimenting. Through experimenting, the students are able to obtain the essence of science in real life. Seeing how things actually works in real life will help...
the students to remember a concept. They don’t merely memorize the concept—they will also understand the concept, if they get to do the experiment by themselves [3]. Through an experiment, the students can find a problem, as well as the answer to the problem they find. The problem which appears during the experiment is a trigger which might potentially help the students to learn even more [4]. Through experimenting, the learning process will also have good scientific content. The problem which shows up will be able to be solved through experiment, without having the teacher lecture the students about the theories [5]. Through experimenting, the students are also trained to use simple valid scientific method, like a scientist [6]. The interesting topics are (1) how can teachers teach the concept of floating and sinking by using student-oriented learning? (2) how does the student oriented learning structure look like?, (3) how is the application of the students oriented learning with scientific approach?

2. Method
The student oriented teaching model and structure found is the result and the output (research and development) done by the researcher. This research is done continuously during SEQIP (Science Education Quality Improvement Project) from 2000 to 2005. The output of the model that is designed by the researcher is evaluated and reflected on the next application, until it arrives at this correct teaching model. Thus, this model is resulted from a long-term study and development by the researcher. The research and development, commonly known as RnD is used to produce and test the effectivity of a certain product [7]. This research is done in 4 stages, namely the deciding, designing, developing, and evaluating [8]. In the beginning of the research, brainstorming, content analysis and literature review are done in order to develop the teaching model. One of the main things to decide in this stage is the topic which will become the model. During designing stage, the researcher designs a teaching model which has 3 stages, namely initial, main, and closing activities, which are synchronized with scientific approach. During the development stage, the researcher keeps trying to improve the weaknesses found on the designed model. Due to the continuous evaluation, it is hoped that the model can be the best real example of a simple yet scientific physics lesson.

3. Result and Discussion
Scientific approach recommends 3 learning, namely: 1) discovery learning; 2) problem based learning and 3) project based learning. According to different from lecturing method, the main focus of these discovery methods is student’s independent activity [9]. The teacher is the one who choose and prepare the material, but the students independently discuss a current problem. The teacher can also ask a certain type of question in the beginning of the lesson. The discussion and most of the activities will then be decided by the students themselves, both during the lesson inside the classroom, and during the group work. This method is known to have several advantages, namely a) developing the students’ independence’, b) stimulating the student’s ability to plan, organize, and conduct an activity, c) developing the students’ sense of responsibility, d) Introducing way of thinking and working in a research. The discovery learning model brings a positive impact on the students learning output [10]. One of the main success of the century’s learning theory and practice is that the students are currently considered as a partner in thoughts and action, and no longer expected to master and memorize the knowledge they don’t understand or the knowledge that are not objectively taught. This discovery learning method makes it possible for the students to experience the feeling of discovering new connections, and how to obtain their knowledge through independent activities. The structure of this discovery learning itself is as follows [9]:

| No | Teaching stages | Objectives                                   |
|----|-----------------|----------------------------------------------|
| 1. | Motivation      | Generating the students’ interest and curiosity towards the learning material |
Problem based learning is about solving the problems that are related to the learning material, not about how teacher informs the learning material [11]. Mentions that Problem based learning with experiment methods provides authentic experience which motivates the students to actively learn [12]. In the early stages the teacher prepares a demonstration to attract students’ interest. The demonstration is programmed to bring out the problems which are going to be the topic. The problem will be answered through a series of students’ experiment or the teacher’s demonstration in main activities.

3.1 Demonstration preparation

To make the students interested in the topic (floating and sinking), the teacher prepares a demonstration using Cartesian Diver. Cartesian Diver is made of reaction tube which is placed to be on the floating position, such as the following picture:

![Figure 1. Cartesian Diver](image)

To make the reaction tube float, the teacher needs to reckon the ratio between the floating substance and the water inside the reaction tube.

3.1.1 Initial Activity

In initial activities, teacher tries to motivate the students into doing cartesian diver demonstration. The teacher asks about the position of the reaction tube in cartesian diver, and introduce floating and sinking based on the position of things. Then, the students are asked to guess what will happen to the tube if it is pressed. The possible answer is that the tube will go up as the water rises when the pressure is applied. Thus, the tube will either float or sink. It turns out that after the demonstration, the tube sinks. Through this phenomenon, it is expected that the students will asks: ‘Why does the tube sink when the bottle is pressed?’. 

3.1.2 Main activities

The problem that should immediately appear in students’ mind is: how does the pressure given to the bottle can make the reaction tube sink? In this stage, the students already have a problem to be solved through an experiment. The students are then asked to construct their hypothesis to be sought. The teacher doesn’t give the answer by lecturing and arranging students discussion. At this point, the students start thinking about the correlation between the pressure applied to the bottle and the reaction
tube. In order to prove their hypothesis regarding floating and sinking, the students are guided through three simple experiments, namely:

Experiment 1
Some things with different measurement are put inside a transparent container filled with water. The students are then given the chance to guess whether the items will float or sink if put into water. Picture 2 portrays an example of the observation:

![Figure 2. Observation Result from Experiment 1](image)

After the students finish observing, the teacher can lead the students’ discussion regarding the output of the simple experiment to obtain conclusion agreed by the whole class. This experiment will give the conclusion that 'whether an item will float or sink depends not on the size of the item, but rather its type.

Experiment 2

![Figure 3. Wax balls](image)

The wax balls is put into water one by one, starting from the smallest one. Before each ball is put into water, the students are asked to guess about whether the balls will float or sink. Picture 4 portrays the result of this experiment.

![Figure 4. Observation Result from Experiment 2](image)

After the students finish observing, the teacher leads the students’ discussion regarding the output of the simple experiment to gain a collective conclusion agreed by the whole class. The experiment will give the conclusion that whether an item will float or sink, is not solely dependent on the type of material it is made of, but also on the shape of the item.

Experiment 3
In this experiment, the class will try to sink a pipette into water, just like the following picture:
After the students finish observing, the teacher will lead the students’ discussion about the output of this simple experiment to achieve a conclusion, namely: Whether an item will float or sink depends on the measurement of the floating substance. Based on the conclusion drawn from experiment 1, 2, and 3, the teacher once again brings up the first problem. It is then expected for the students to figure out that the reaction tube sinks because the measurement of its floating substance decreases.

### 3.2 Closing activities

In consolidation activities, there are a few things that the teacher should address. One of the most important application of this topic is about how a submarine can float and sink in water and how a fish can do so too. This is a rather interesting topic related to floating and sinking. If we compare the stages used in this lesson with the scientific approach of Curriculum 2013, we get the appropriate stages. There are 6 stages of scientific approach, namely: (1) observing (2) asking a question, (3) collecting information (4) associating (5) concluding, (6) communicating [13]. The demonstration through cartesian diver is proven to be able to attract the students’ interest. Each student tries to explain the phenomenon using their own logic. This is included as observing stage in scientific approach of Curriculum 2013. In order to look into each opinion, the students are then asked to do a series of experiment, while first try to ask a question: ‘why does the reaction tube sinks when pressed?’ This question is best figured by the students by directly asking (asking a question stage). Then, the class enters collecting information stage, associating, and concluding. to answer this problem, the teacher then asks the students to do some experiments.

The first experiment in which the students put several types of items with different measurement in water, aims to guide the students into concluding that whether an item will float or sink depends not on its size, but its material. The second experiment is done to inform the students through experiment that in addition to the item’s material whether an item will float or sink also depends on the shape of the item. This is shown when the wax balls, which previously sink can float when its shape is changed. Through experiment 3, the students figure out that, apart from its materials and its shape, the measurement of the floating substance also influence whether an item will float or sink. It is then expected that from these three experiments, the students are able to answer the initial question themselves. If we observe the time when the bottle is pressured, the measurement of the floating substance inside the reaction tube decreases because the water surface increases inside the reaction tube. Last is the communicating stage, in which the class explain the application of the concept. The concept is applied in a submarine. In a submarine, there is a specific room that can change the measurement of its floating substance by putting in and out water from the room.

Based on the learning activities, it is students who must actively manage, search and find solid concept buildings for better understanding. Student-oriented learning is learning that will attract students' efforts in building their own knowledge. Gunawan et al. [14] and Wahyuni et al. [15] stated that students must be facilitated by the teacher in finding their own knowledge. Knowledge built on personal experience and independent business will be more attached and meaningful than forced knowledge.

### 4. Conclusion

![Figure 5. Observation Result from Experiment 3](image-url)
Scientific approach is very suitable for physics lesson. It is proven that this learning helps the students to further understand the concept they are learning, as well as become more enthusiastic and active in following the lesson. The same occurs to the teacher. This method demands many skills from the teacher. For example, the teacher should master the material, be used to thinking logically like a scientist, be democratic and alert in reading another people’s mind. Teacher should also open to improvement. The belief that scientific approach will limit the teacher’s creativity is proven to be false, because it turns out that scientific approach in Curriculum 2013 gives the teacher a chance to optimize her/his creativity and innovation.

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