The development of PDEODE*E task based three stay two stray on static fluid

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Abstract. Misconception occur due to several factors, including students, teachers, content of book or teaching materials, and learning models and strategies used. Learning models and strategies greatly affect to the ability of student’s understanding of the concept. Low conceptual understanding can easy make the students being misconception. Therefore, the purpose of this research was to developing PDEODE*E task based one of cooperative learning model type on static fluid material. This research used 4D method (Define, Design, Develop, Disseminate) and this research restricted on static fluid conceptual. Participant in this research are 25 XI grade students on science program. This research used effect size to analyze the impact of PDEODE*E task based three stay two stray to reduce the students’ misconception. Results shown that the value of effect size is 1.09 with “large effect” interpretation. It’s mean that PDEODE*E task based three stay two stray is effective to use on learning activity in the classroom to reduce student’s misconception on static fluid.

1. Introduction
Misconception is a different concept of students with a concept of expert [1-6]. Misconception occur due to several factors, including students, teachers, content of book or teaching materials, and learning models and strategies used [1,2]. Every student has different abilities to understand the physics concept. Thus, students have different interpretations, which make the students being misconception. Student’s misconception also caused by wrong preconception which students has, so that it brought into the next educational level which made the students misconception [7]. Misconception also often arises because the teacher doesn’t have a good ability to teach in the classroom, lack of material mastery, and use the inappropriate teaching method used [2]. Misconception influence students learning concept. Therefore, very important to determine student’s misconception as well as their source and develop suitable teaching strategies in order to remedy them [8].

The research by Fratiwi et all (2017) and Zulfikar et all (2017) show that PDEODE*E learning strategies is effective to improve student’s understanding conceptual and reduce student’s misconception [3][9]. In this research used PDEODE*E learning strategies to reduce student’s misconception with one of type cooperative learning model. The type is three stay two stray. Three stay two stray is one of type of cooperative learning model which develop from two stay two stray cooperative learning model. The different lies in amount of member in one group. In this research focused in two concepts, there are hydrostatic pressure and Archimedes law.

Hydrostatic pressure is a pressure deliver from a liquid that moves statically. Hydrostatic pressure depended by the fluid density ($\rho$), gravity (g), and depth (h). The formulation to determine a magnitude of hydrostatic pressure given by equation 1.
\[ P_{H} = \rho gh \]  

Shape, size, surface area of vessel are not depend the magnitude of hydrostatic pressure. Same like volume or weight of a fluid, there are not depend the hydrostatic pressure. Because, some of this weight is sustained by the normal force given by the sides of the vessel, which has an upward component. Thus, the weight of the water does not affect the amount of pressure at a certain height in a vessel. Usually, students assume that shape, size, surface area of vessel and weight of the fluid affect to hydrostatic pressure. So that, this is have to be remediated.

And then, we discuss about Archimedes law. Archimedes law stating that anybody totally or partially inundated in a fluid (gas or liquid) at respite is acted ahead by an upward (buoyant) force the magnitude of which is equivalent to the weight of the fluid displaced by the body. The volume of displaced fluid is equal to the volume of an object totally submerge in a fluid or to that portion of the volume beneath the surface for an object partially submerged in a liquid. The weight of the displaced portion of the fluid is equivalent to the magnitude of the buoyant force.

Bouyant force depended by the fluid density \((\rho_f)\), volume of fluid which displaced \((V_f)\), and gravity \((g)\). The formulation to determined a magnitude of buoyant force given by equation 2.

\[ F_b = \rho_f g V_f \]  

2. Methods

The purpose of this research was to developing PDEODE*E task based one of cooperative learning model type on static fluid material. And the participant, design, instrument and data analyze which used in this research will discussed in following discussion.

2.1. Participant

Amount participant in this research are 25 students from XI grade science program (14 boys and 11 girls who have an average age between 17 years old).

2.2. Design

The research method used 4D, which in this method has 4 steps, there are define, design, develop, and disseminate. At the part of Define and Design, the PDEODE*E task was defined and designed. Then, in Develop, we customary the task and modification two stay two stray to be three stay two stray to combine with PDEODE*E task. Furthermore, at the Disseminate part, we investigate and analyze the impact of a PDEODE*E task based three stay two stray on static fluid. Whether it can be reduced student’s misconception on static fluid or not.

2.3. Instrument

For diagnosis student’s misconception, researcher used four tier test which validated by two physic lectures and one physics teacher. And the PDEODE*E task which validated by two physics lectures and one physics teacher.

2.4. Data Analyze

Developing PDEODE*E task bades three stay two stray would analyzed by effect size to investigate the impact of PDEODE*E task based three stay two stray to reduce student’s misconception on static fluid.

3. Result and Discussion

PDEODE*E Task based Three Stay Two Stray give a significant conceptual change in static fluid material. In development, researcher used 4D (Define, Design, Develop, Disseminate). For detail, discussed in the following discussion.

3.1. Define

Define step is a step for determine, give a definition about the research. This research was to developing PDEODE*E task based one of cooperative learning model type to reduce senior high school student’s
misconception. One of cooperative learning model type which the researcher choose is three stay two stray. Three Stay Two Stray is the development of two stay two stray cooperative learning model in amount of groups member without change the technique.

PDEODE*E has seven steps. The first step is Predict (P), in this step, teacher give an occasion for students to predict the phenomenon will be held and the students write their prediction on the worksheet that the teacher gave. The second step is Discuss (D), in this step, students discuss with their group about each of their prediction about the phenomenon. And then, the third step is Explain (E), students in each group explored to scrunch a conciliation and assumption about the phenomenon, and to present their idea to other groups accomplished class discussions. Next step is Observe (O), the students start to begin the experiment but they have not to collect a data. Students observed vicissitudes in the phenomenon and the teacher primes them highlighting to their observations that related to the besieged concepts. After that, next step is Discuss (D) again, the students were requested to investigate and associate the finding on their groups. Next step is Exploration (E*), to bring conceptual change and to advance conceptual understanding. In this step, students explore the phenomenon by themselves. And the last step is Explain (E) where students compare the result from their prediction, observation, and exploration. In this step, students can explain the the phenomenon with truly concept [4,8].

3.2. Design
In this step, researcher designing some of the things required for this research. The first design that was made was four tier test as in Figure 1.

![Figure 1. Four Tier Test For Identify Student’s Misconception.](image)

PDEODE*E learning strategies implemented in the form of PDEODE*E task to minimizing undelivering conceptual on the students. This is design of PDEODE*E task which was used in this research.
Figure 2. PDEODE*E task on the first page.

Figure 3. Observe Part on PDEODE*E task.

Figure 4. Exploration (E*) part on PDEODE*E task. Students should take a data.
3.3. Develop

This step is implementation of the design that has been made. The development in this study lies in amount of members within a group of student learning. If in the two stay two stray type cooperative learning model, a learning group consists of four group members in which two members work in their group to collect information provided by another group that visits into their group and two other members visit another group to obtain information about information needed, while in the three stay two stray cooperative learning model, a group consists of five group members in which three members work in their group to collect information provided by another group that visits into their group and two other members visit another group to obtain information on the required information. One person is here assigned to decision-makers in his group when all members are reunited after discussing and looking for supporting information from other groups whether the information is acceptable or not to support the knowledge that will be written on the PDEODE*E task that has been given.

Combined with PDEODE*E learning strategy which was implemented with PDEODE*E Task, can reduce students misconception on static fluid material. Especially on the concept of hydrostatic pressure and Archimedes law.

3.4. Disseminate

At this step, effect size is used to measure the impact of PDEODE*E task based three stay two stray to use on learning activity in the classroom to reduce student misconceptions on the concept of hydrostatic pressure and Archimedes law with the following formulation.

$$ \Delta = \frac{X_{post\ test} - X_{pre\ test}}{SD_{pre\ test}} $$  \hspace{1cm} (3)$$

After a large effect size is known, then interpreted in accordance with the following Table 1.

| Glass’s Delta | Interpretation   |
|---------------|------------------|
| .00 ≤ Δ < .20 | Trivial Effect   |
| .20 ≤ Δ < .50 | Small Effect     |
| .50 ≤ Δ < .80 | Medium Effect    |
| Δ ≥ .80       | Large Effect     |
Effect size obtained from the results of pre test and post test students when given treatment using PDEODE*E task based three stay two stray can be seen in the following Table 2.

Table 2. The Effect Size of Data.

| Score     | Average (\(\bar{X}\)) | Standard Deviation (SD) | Effect Size | Interpretation     |
|-----------|------------------------|-------------------------|-------------|--------------------|
| Pre Test  | 10.56                  | 3.57                    | 1.09        | Large Effect       |
| Post Test | 14.48                  | 3.38                    |             |                    |

On the Table 2 the value of effect size is 1.09 with an interpretation “large effect”. It’s show that development of PDEODE*E task based three stay two stray give a large effect toward reducing students misconception in static fluid materials. It means that PDEODE*E task based three stay two stray is effective to reduce student’s misconception on static fluid.

On the PDEODE*E task, the student write their prediction about the phenomenon that will be held. Then, students discuss and about their prediction into the group and explain the reason why they predict that phenomenon. After that, the students with their group observe to convince their prediction about the phenomenon and discuss about that in their group. And then, the student start to explore the experiment to get truly phenomenon and concepts by the data which they get from the experiment. So that the students can analyze, associate, and interpretation about something was happening to get a truly concept which agreed the expert. And the last part, students should explain the phenomenon was happen with compare based on their prediction, observation and exploration.

After the student explain on the group, two member of the group visit into the other group to share and discuss about their discovery and three member of the group accept the two member from the other group to discuss and get the information from the others group.

One of student’s prediction, observation and exploration can see at the Figure 6, 7 and 8.

![Figure 6. Student’s prediction which write into the PDEODE*E task.](image-url)
Based on the Figure 6, 7, and 8 we can see that the students can find the concept separately. The teacher just as a guide for students to solve the problem.

4. Conclusion
Based on data analysis, we get a conclusion that development of PDEODE*E task based three stay two stray is effective to use on learning activity in the classroom to reduce student’s misconception on static fluid. With the value of effect size is 1.09 that explanation as “large effect”.

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**Acknowledgement**
Big thanks to Mr. Aan Suhirso and Mr. Rindu who was gave the researcher a permit for this research. And Riset Hibah DIKTI, Kemenristek DIKTI, Indonesia.