Improving students’ conceptions on fluid dynamics through peer teaching model with PDEODE (PTM-PDEODE)

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Abstract. This study based on an importance of improving students’ conceptions and reduces students’ misconceptions on fluid dynamics concepts. Consequently, should be done the study through combining Peer Teaching Model (PTM) and PDEODE (Prediction, Discuss, Explain, Observe, Discuss and Explain) learning strategy (PTM-PDEODE). For the research methods, we used the 4D model (Defining, Designing, Developing, and Disseminating). The samples are 38 students (their ages were an average of 17 years-old) at one of the senior high schools in Bandung. The improvement of students’ conceptions was diagnosed through a four-tier test of fluid dynamics. At the disseminating phase, students’ conceptions of fluid dynamics concepts are increase after the use of PTM-PDEODE. In conclusion, the development of PTM-PDEODE is respectable enough to improve students’ conceptions on dynamics fluid.

1. Introduction

Researchers as of a diversity of academic perceptions have claimed that the essential feature that students take along to their lessons is their conceptions [1,2]. Conceptions continuously construct upon students’ obtainable thinking concluded school tutelage otherwise their ordinary familiarities [3,4,5]. The inadequate of students’ conceptions can chief to misconceptions. Other concepts in physics learning are informed that has misconceptions on students [3,6,7,8,9], for example, fluid dynamics concepts. In fluid dynamics concepts, especially Bernoulli’s principle, students do not understand the concepts and the formulation (as shown by Equation.1) which may arise misunderstanding.

\[ p_1 + \frac{1}{2} \rho v_1^2 + \rho gh_1 = p_2 + \frac{1}{2} \rho v_2^2 + \rho gh_2 \]  

Student that is capability misconceptions are demanding to modification as of incorrect to correct understanding [10,11,12]. Gok [13] show that a lot of students were authority physics course by the unchanged misconceptions as when they cross the threshold the course. Therefore, teachers should be able to complement and improve students’ conceptions.

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To improve students’ conceptions, we can choose one of the learning model that is Peer Teaching Model (PTM). PTM is a practice where students’ exertion collected through students [14,15]. PTM offers a designed situation for students to expression their thinking and steadfastness misconceptions through conversation by their peers [16]. Furthermore, PTM is as thriving an applicable technique for science instruction and can advantage students distinguish when they do not comprehend a concept [14,16]. The achievement of PTM is deliberated to be grounded on the efficiency of social collaboration [14].

Moreover, most instruction in science does focus on helping students’ development of understanding of scientific ideas and does it help them learn how to apply the concepts outside of school in the real world in which they live [17,18]. Learning strategy should be established for teachers in command to deliver students to create linking among their understanding of science and linked routine conditions. The existing research efforts to measure efficiency of PDEODE learning strategy on the grade to which students receive scientific concepts then practice them aimed at understanding the phenomena in routine conditions [17]. The PDEODE learning strategies have six stages, they are P (Prediction), D (Discuss), E (Explain), O (Observe), D (Discuss) and E (Explain) [17,19]. PDEODE learning strategy can be an in effect incomes together of facilitating students create logic of routine conditions and conceptual change aimed at summarizing [17]. Therefore, the combining of PTM and PDEODE learning strategy be expected to improve students’ understanding on fluid dynamics concepts.

2. Methods
The research method is 4D model with four phases, they are Defining, Designing, Developing and Disseminating) [3,10]. At the defining phase, we explore the definition of Peer Teaching Model and PDEODE learning strategy. At the designing phase, we design the PDEODE teaching doings sheet. At the developing phase, we developed the PDEODE worksheet. At the disseminating phase, after the use of PTM-PDEODE, we diagnose the category of students’ conceptual (Sound Understanding/SU, Partial Understanding/PU, No Understanding/NU, Misconceptions/MC and No Coding/NC). The diagnosing was used four tier test of fluid dynamics. The samples are 38 students (their ages were an average of 17 years-old) at the one of senior high school in Bandung.

3. Result and Discussion
Based on the study, students’ conceptions can be improved after the PTM-PDEODE. The PTM-PDEODE was developed by used of the 4D model (Defining, Designing, Developing and Disseminating). The outcomes of this study are explanations as follows.

3.1. Defining
Peer Teaching Model (PTM) has a lengthy practice whose early stages can be outlined hind to the earliest Greeks [14]. PTM is a student-centered method where students effort together through students, to progress the instructional excellence of science learning [14, 16]. PTM of two until five students settled together were formerly examined to deliberate these answers, deliberate on the dissimilarities and exchange a communal answer [13,16]. PTM delivers an organized situation aimed at students to opinion their thinking and determination misunderstandings through conversation by their peers. By means of occupied together to study new concepts, students make a more cooperative learning situation that highlights learning as an unrestricted in the classroom. Further researches also expression that specialists are talented to observer and control their personal understanding [16].

Nevertheless, PTM can be combining through PDEODE learning strategy because this is a significant learning strategy in which there is an air that provisions discussion and assortment of interpretations [17]. PDEODE learning strategy firstly is recommended by Savander-Ranne & Kolari and first used by Kolari et al. [17]. The PDEODE learning strategy have six stages, they are Prediction, Discuss, Explain, Observe, Discuss and Explain [17, 19]. Performance these, the students commence to determination the illogicalities that may happen among their principles [17].
3.2. Designing
In the designing phase, we design the PDEODE teaching doings sheet as shown by Figure 1.

![Figure 1. Design of PDEODE worksheet](image)

At Figure 1, the PDEODE worksheet was adaptation by Costu [17]. The task is aim of the experiment. The figure of experiment is the real set of experiment tools or sketch tools. The figure description is the explanation of the experimental tools. The Predict, Discuss, Explain, Observe, Discuss and Explain are students activity in the construct the concepts.

3.3. Developing
After we design the PDEODE worksheet, we developed it. The PDEODE worksheet was adaptation by Costu [17], shown at Figure 2.
3.4. Disseminating

Based on the data analysis, we categories students’ conceptual, there are Sound Understanding (SU), Partial Understanding (PU), No Understanding (NU), Misconceptions (MC) and No Coding (NC). The percentage of students’ conceptions was shown at Figure 3.
At Figure 3, we can see that experiment group improve their understanding of fluid dynamics concepts. The category of Sound Understanding was increase from 14% to 50% after the implementing the PTM-PDEODE. Other than that, the category of Misconceptions, No Understanding and Partial Understanding were decrease after the learning with PTM-PDEODE. As we can see, the percentage increase of SU in experiment class is greater than control class (with conventional learning). Accordingly, Costu [17] conclude that PDEODE learning strategy was effective income equally of facilitating to conceptual change and to students make sense of everyday situations.

4. Conclusion
Based on the study, students’ conceptions can be improved through Peer Teaching Model based PDEODE (PTM-PDEODE). On PTM-PDEODE, we developed the PDEODE worksheet which can be used to investigate the concepts of fluid dynamics. At the disseminating, students’ understanding increase from 14% to 50% and other category were decrease.

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