Creative, critical and argumentative scientific skills on the concept of fluid dynamics: Case study on Vocational High School students

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Abstract. This research aims to analyze the scientific skill in creative thinking, critical thinking and argumentation thinking of vocational High School students in Tangerang district on the dynamic fluid concept. This research used case study and description analysis by using instrumental such as creative, critical and argumentative scientific skills. The participant of this research were 33 students from ninth-grade of TSM this one of SMK Tangerang Regency. The instrument used in this research were one case consisted of 4 creature scientific thinking indicators with a reliability value of 0.87 and belonging to the high category and one case consisted of 4 scientific argumentative ability with a reliability value of 0.7 and sufficient category. The result of this research showed that the students' average score of creative scientific thinking on dynamic fluid was 34.14 from maximum score 100, so they were in low category. The average of students' critical thinking was 24.5 from the maximum score and they were in the low category. However, the average of the students' argumentative ability was 43.67 from maximum score 100 and they were in the low category.

Keywords: analysis, creative thinking, critical thinking, and argumentation skills.

1. Introduction

In this era of globalization, humans are required to have the ability to adapt global challenges that will come. Therefore, the government conducts curriculum development to improve the quality of human resources in order to face inter and external challenges. In the 2013 curriculum, the revision has the objective of preparing Indonesian people to have the ability to live as citizens and citizens who are faithful, productive, creative, innovative, and affective and able to contribute to the life of society, nation, state and civilization of the world.

Approaches of science can be done by asking questions directives and practicum activities that become a means for learners in finding concepts, and also can develop the creativity of learners in learning. It also complies with Permendikbud Number 54 of 2013 [1] on basic competence in physics subject which requires learners to have scientific behavior (have curiosity, objective, honest, meticulous, meticulous, diligent, responsible, open, critical, creative, innovative, and caring
environment) in daily activities as a form of attitude implementation in conducting experiments and discussions.

Based on teacher and student interviews, conducted at one State Vocational High School in Tangerang Regency, it is learned that physics learning emphasizes more on physics problems, especially calculations, lack of delivery of physical concepts, lack of trained critical thinking and creative thinking, lack of examines the students' thinking processes in discussions and scientific debates, learning activities that rarely build students through experimentation, and a lack of explanation of conceptual interrelationships with applications as well as natural phenomena in everyday life.

White and Brian et.al [2] argue that critical thinking skills are needed to develop an educated society which involves knowledge in terms of the ways in which thinking is used. Torrance [3] states that creative thinking is a skill of thinking by using mental operations, namely fluency, flexibility, authenticity and the disclosure of ideas to produce something original, new and valuable. Hu and Adey [4] assert that creative thinking requires scientific knowledge and techniques in solving problems in order to create a new understanding and solutions made based on a combination of knowledge and techniques. Scientific creative thinking includes three aspects: fluency, flexibility and originality. Fluency is defined as the number of ideas that are original. Flexibility is the ability to change attitudes, not tied to a frequently used approach. Originality is interpreted to occur only occasionally in certain populations. Through the process of debating learners learn various scientific concepts and have the opportunity to train students' scientific skills. By arguing, the participants will think better than understanding the content especially in science. Deane and Suong [5] argue that argumentation plays an important role in developing a critical thinking pattern and adds an in-depth understanding of ideas and ideas.

Improved critical thinking skills, creative thinking and student argument skills are known when teachers know how much of their input. So we need a profile picture of critical thinking skills, creative thinking, and student argumentation, especially on the concept of physics. Dynamic fluid is one of the physics materials that its application is widely used in everyday life. Therefore, in this preliminary study, the author tries to know the profile of critical thinking skills, creative thinking, and student argumentation on the concept of dynamic fluid.

2. Method

This preliminary study was conducted on 33 students of class XI in one as vocational high school in Tangerang District in the academic year 2017/2018. This preliminary study used a descriptive preliminary study to find out critical thinking skills, creative thinking, and student arguments on the concept of dynamic fluids. The sampling technique used in this preliminary study is a purposive sampling technique. This preliminary study path, carried out literature studies related to preliminary study focus, interviews with physics teachers at school, and provides a preliminary study instrument. The preliminary study instrument is in the form of casual fluid-related casualties to measure critical thinking skills, creative thinking, and student arguments.

Critical thinking skill refers to the creative thinking of Hu and Adey which is limited by combining aspects that combine processes (imagination, thinking), trait (fluency, flexibility, originality), and product (technical product, science knowledge, science phenomena, science problem) incorporated in the Scientific Structure Creativity Model (SSCM). Critical Thinking Ability 1, Critical Thinking Ability 2, Critical Thinking Ability 3. The skill of Argumentation refers to Toulmin Pattern (TAP) argumentation [6], which contains a component of claims, evidence, justification, and support. Before this instrument was used in the preliminary study, first tested the expert validation to correct the problem that was not in accordance with the measurable indicator. Then test the reliability with retest to see the level of the tested problem with the same group at different times. Reliability test results obtained 0.9 with very high category. It is critical that critical thinking skills instruments, creative thinking skills and student argumentation skills are worthy of use in this preliminary study.

Result and Discussion

The results of this preliminary study, showing under the students' critical thinking skills, were obtained at 24.5 from the maximum score of 100. Also, the results of each indicator of critical thinking can be seen in Figure 3.1 below.
Figure 3.1 skill profile of students thinking on the concept of dynamic fluid
The table above shows that students' critical thinking skills are still low. This is because the critical thinking skill is less developed by the teacher, so that the students still cannot express their opinions flexibly, and still limited in opinion or give input.

3.2 figure of profile creative thinking skill student
Similarly, critical thinking skills of the same results are also obtained on students' creative thinking skills, which show an average of 38.14 out of 100 which means still low. The value per indicator can be seen in the table below:

Figure 3.2 profile of students' creative thinking skill on dynamic fluid concept
The table above shows that students' creative thinking skills are still low. This is because the creative thinking skill is less developed by the teacher, so the students still cannot express their opinions graciously, and still limited in opinion or give input. The argumentation skill measured in this study refers to Toulat's argumentation pattern (TAP). The average yield obtained was 43.67 out of 100 in the low category. The result of students' argumentation skill assessment on dynamic fluid concept is presented as follows:
Figure 3.3 skill profile of students Argumentation skill on the concept of dynamic fluid

Viewed from Figure 3.3 above on every indicator is still low. Although on the indicator of claims at a moderate level but on other indicators low this is because students only can give an opinion only without supported by data, justification, and support related to the concept. Following up the profile of critical thinking skills, creative thinking, and student argumentation skills can improve the quality of better learning in schools in Indonesia.

4. Conclusion
The conclusions obtained based on the results of research, showed that students' creative thinking skills on the concept of dynamic fluid obtained an average of 38.14 from a maximum score of 100 and are in the low category. In critical thinking skills students obtained an average of 24.5 from a maximum score of 100 and are in the low category. Semnatar on argumentation skills obtained an average of 43.67 from a maximum score of 100 and is in the low category.

5. References