Consistency Study about Critical Thinking Skill of PGSD Students (Teacher Candidate of Elementary School) on Energy Material

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Abstract. This study aims to examine the consistency of critical thinking ability of PGSD students in Energy material. The study population is PGSD students in UNS Surakarta. Samples are using cluster random sampling technique obtained by 101 students. Consistency of student's response in knowing the critical thinking ability of PGSD students can be used as a benchmark of PGSD students’ understanding to see the equivalence of IPA problem, especially in energy material presented with various phenomena. This research uses descriptive method. Data are obtained through questionnaires and interviews. The research results that the average level of critical thinking in this study is divided into 3 levels, i.e.: level 1 (54.85%), level 2 (19.93%), and level 3 (25.23%). The data of the research result affect to the weak of students’ Energy materials’ understanding. In addition, indicators identify that assumptions and arguments analysis are also still low. Ideally, the consistency of critical thinking ability as a whole has an impact on the expansion of students' conceptual understanding. The results of the study may become a reference to improve the subsequent research in order to obtain positive changes in the ability of critical thinking of students who directly improve the concept of students’ better understanding, especially in energy materials at various real problems occured.

1. Introduction

Critically thinking could be a way to improve natural science which grows in the student’s mind [1]. The government has a role to arrange educational policy, due to the implementation of the policy such as education curriculum [2]. The emerging of demand to invite elementary students to be able to develop their critical thinking according to PP 24 year 2016 about the revised curriculum of 2013, become a challenge to the elementary teacher. The teacher candidates are also asked to prepare themselves to become a good teacher and ready to hold the responsibility [3]. One step to overcome that situation is to enhance the teacher candidates’ ability in thinking critically. The implemented simulation activity might not improve the critical thinking ability of the students [4]. Designing of systematic material is also important to develop the bachelor’s ability in thinking critically [5]. This phenomenon emerges when they are asked some questions regarding natural science which push them to think but make them difficult to answer. In order to simplify the learning process, especially in
aligning the perception and enhancing the critical thinking ability, it is useful to develop the best learning model.

Every model includes interactions among students, between teacher and students, and between students and the sources which shows a measured communication. Interactions and communication in learning process are generally used by teachers in a daily life [6];[7]. As a model, inquiry may be defined as an actual process of the scientist to disclosure the reality, and it is believed that adaptation in knowledge instructions may help students to understand the natural behavior [8]; [9]; [10]. Arslan says that inquiry learning sometimes makes students learn either less border or focused on one teacher in learning [11]. However this condition create a burden in critically thinking for the students, especially PGSD students. This paper aims to analyze further activity taught by the teacher and students activity in energy learning, which shows the importance of how to pay attention in the students’ consistency of the critical thinking [12].

This research describes problems which focus on how critical thinking ability occured. The main point of this research is designing framework, planning study subjects, students’ critical thinking, and the role of teachers. Doing this research may give a proven strategic solution to enhance the students’ critical thinking.

2. Method
This research is using descriptive research method. Data are obtained by using reasoned multiple choice to measure the consistency of the students’ argumentation. The test consist of eight items. Every items are shown in a verbal form, picture, and graph (table). Natural science materials tested is about energy. Tested item used by the research is a result of validation of content from the expert judgment and also statistical calculation. Categorization of students to see the consistency of critical thinking ability refers to: inconsistent if more than two pairs are wrong in doing the consistency test; and consistent if all the test questions are delivered consistently. Categorization the consistency of the student’s critical thinking ability is measured by using Ennis’ modified critical thinking ability rubric.

Data research are obtained from 101 students of the PGSD UNS

3. Result and Discussion
The problem sets used in this research have been analyzed its validity and reliability. They have been simulated to 101 UNS students, regardless the main samples. The result shows that the average is calculated as 3.01 with table 2.02 which indicates a valid problem. The reliability is categorized as sufficient if the probability score is at 0.43 and significance level is at 0.05. The consistency percentage of the students’ argument is based on the research showed in Table 1.

Table 1. Percentage of Critical Thinking Consistency

| Level consistency       | (%) PGSD Surakarta |
|-------------------------|--------------------|
| Low consistency         | 54.85              |
| middle consistency      | 19.93              |
| Consistency             | 25.23              |

Table 1 shows the percentage level of student’s critical thinking. It figures out how students fail to understand a problem set of conceptual understanding. Therefore, some students who have the lowest level are interviewed to overview the problem emerged. The resume of the interview is that “students generally finish the natural science problem set only based on existing theory and concepts. Based on the data of research result and stressed by the interview result, it needs a paradigm shifting by planting concepts that is integrated with natural science basic concepts to exercise their critical thinking analysis. Table 1 describes the percentage of the categorization of students’ critical thinking ability. Those are supported by interview result from some students who answer all three consistency category in critical thinking ability. The resume of interview will be that the consistency level is 54.85. This reflects that student fails to understand the problem in the form of conceptual understanding. Rely to this circumstance, some of the lowest level students were interviewed to explore the problems that occurred. The summary of the interview is that "students are accustomed to solve the problem of science only based on the existing theories and concepts". Based on the results of
data research confirmed by the interview, there needs a shift paradigm by implementing an integrated concept and giving students a problem which contains basic concept of science to train their critical thinking skills [13].

![Figure 1](image)

**Figure 1.** Consistency Study about Critical Thinking Skills of Students (Teacher Candidate of Elementary School) on Energy Material

Related to Figure 1, the percentage of categorization of consistency of students' critical thinking ability is supported by interview data from several students who answer three categories of consistency of critical thinking ability. The summary of the interview shows that students have a low response ability in pouring concepts into a form of writing by giving an argument for the given answers. Consistency of critical thinking requires more understanding from the students to see the equivalence between the choice of answers and the reason for the answer. Students’ tendency to guess is very high in this research. It can be seen that none can give answer in accordance with key sentence in given problem [14]. “Consistency of students' responses in understanding energy concepts requires more understanding of students to see the equality of energy issues poured in various ways ”. Deeper understanding will make a student to be consistent with what he understood and believed to be true. The indirect impact of consistency, even though it is believed to be scientifically incorrect, consistency of students will lead them to a better level of understanding in the view of the various concepts of science, especially energy that is poured into various problems [15-17].

A problem is given to the students, who were asked to describe which water is quickly boil from several levels of altitude [18]. This problem requires an answer and the reason is right. Based on the data, students averagely choose answer a, as for the reasons written that the student has given argument in accordance with the keywords that are implicitly presented on the problem [19]; [20]. I.e. objects having "vary” masses. The argument given still looks weak. Students should also provide arguments from the density of objects and water point of view. This illustrates that the consistency of arguing students at level 1 is inconsistent or weak. Therefore, the consistency of students’ critical thinking ability will be categorized above level 1. It is if the students start the analysis from the point of view of the second object which has been determined its position and has the same density as the water. Students may assume that object 1 must have smaller density than object 2, and object 3’s density is bigger than object 2. So, it may be assumed that beam 3 will sink and beam 1 will float partially. In addition, related to the mass of "varied" objects, students should know that the density of object 3 is larger than object 2, so the student can conclude that the 3 blocks are submerged.

Weak consistency of students' critical thinking skills may indicate that the technique of teaching science in the field is not visualized. The results in the concept of energy only leads to a memorizing alone. Furthermore, students also have a tendency to put forward how to solve problems with mathematical equations without understanding the physical meaning of each equation used to solve the problem. This results a weak understanding to master the energy materials.
The presented problem in Figure 2 deals with uplift (FA) with the FA = ρgV equation. The FA on each object is influenced by the extent of the touch field of the object to water. It means that the object shape affects the FA experienced by the object. This appears to be aimed at the concept of fireballs and submarines. The answer given by the students are tend to guess and inconsistent. This can be interpreted that the students have difficulty to remember that the volume of dyed objects are obtained by reducing the volume of water before the object dipped with water volume after the object dipped. In addition, students have less focus on referral questions and stem answers. Students should be able to identify that the volume, type of material, and the type of object are assumed to be the same. Therefore, if the density is the same then the volume of all three objects is assumed to be the same. The ability to analyze problems indirectly may convince students to consistently think critically, especially in giving reasons for the chosen answer. In fact, the option of the selected answer is wrong and the reason for the answer is beyond the grid of answer that should be written by the student. Low ability of understanding a problem in that matter resulted by low understanding of the students in a concept of science, especially energy materials.

Furthermore, several other evidences of this study include the problem of how students' consistency think about problem solving in finding the right solutions. They use it to strengthen the consistent aspects of student's critical thinking to stimulate an enjoyable learning. Some students that show increased learning are discussed in study groups that they find comfort and fun.

4. Conclusion
Based on the result of research, it is found that the average consistency level of thinking ability is inconsistent, less consistent and consistent, i.e. 54.85%, level 19.93%, and level 25.22%. The data describes the level of consistency of students' critical thinking skills where students will only be involved in critical thinking skills when they find something they know on the job. Therefore, students need to understand the content deeper if the given problem is abstraction. This has significant implications on how learning promotes a development of critical thinking skills. The development of consistency of critical thinking ability is in stark contrast with the scientific concept. Therefore, it will produce an appropriate discourse, meaningful discussion of scientific point. Basically, students have idea trying to solve the problem but always fail and trying to assert their own arguments with weak statements. Therefore, students cannot be involved in the developing scientific concepts and theories if students have no knowledge background. It is not only about students who do not understand the task aspects (or teacher's learning) that are not accustomed to both in terms and / or levels of abstraction, but also how students' struggle in understanding each other as quick as their constructs are different.

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