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## Identifying the Student's Critical Thinking Ability of PGSD in Accomplishing the Energy Material Problems

Murwani Dewi Wijayanti<sup>1</sup>, Sentot Budi Raharjo<sup>2</sup>, Sulistyono Saputro<sup>2</sup>, Sri Mulyani<sup>2</sup>

<sup>1</sup>Postgraduate student of UNS Science Education, <sup>2</sup>Lecture of UNS

Corresponding email: murwanidewi@student.uns.ac.id

### ABSTRACT

The development of science and technology in educational world becomes one of center of interest because of its quality enhancement efforts. One effort to improve the quality of education is by focusing the learning model used. Beside, educational world asks human ability to filter the information. Therefore, human must think critically. In the education world, thinking critically can be taught through natural science because it is a thinking tool that is able to develop analytical and logical thinking. There are many ways to lead students in thinking critically. One of them is by doing the natural science problems, especially related to energy materials that needs critical thinking. By doing that way, it is hoped that student will be skillful in accomplishing problems logically and systematically. The objective of this research is to describe the critical thinking ability level of students. The subject of the research is students of PGSD from 3 level universities which consist of 103 students. The students given critical thinking test then will be categorized into level 4 (critical), level 3 (moderate critical), level 2 (less critical), and level 1 (no critical). The result shows that the students at level 4 consist of 14 students (4%), level 3 consist of 16 students (16%), level 2 consist of 36 students (35%), and level 1 consist of 47 (45%). Instead of the level of critical thinking, it is needed to categorize the consistency level of students critical thinking ability. The consistency level of students' critical thinking ability only relates to something they know at their tasks; Sebelas Maret University at 56.5%, State University of Yogyakarta at 62.2%, and Univet at 64.50%. The students' weakness in their consistency may indicate that material learning technique about energy has less focus on critical thinking ability. In doing their tasks, students tend to answer without considering the right analysis. Oneway to improve the critical thinking ability of the students is by implementing a structural inquiry learning model.

**Keywords:** Critical thinking, Problem solving

## 1 INTRODUCTION

The ability of PGSD students is that elementary teachers may integrate science aspect separately is the main factor in cognitive development. The ability of critical thinking give a possibility for students to focus on their understanding development about energy material of science knowledge. The content element of student's understanding is built by constructing the knowledge development based on the understanding the science knowledge material self.

Talking about critical thinking ability firstwill explain the definition of the thinking itself. Thinking is a mental ability that exists in every individu. Yuli (1999) states that thinking is a mental activity which experienced by individu if they face problem or situation that must be solved. Moreover, Ruggiero (Yuli 2009: 11) explains thinking is a mental activity to help the formulation or

problem solving, decision making, and fulfil a desire to understand. This statement shows that when a person formulate a problem, so he/she will do a thinking activity.

This research uses thinking characteristic: (1) ability to differentiate relevant information, (2) ability to detect the deviation, (3) ability to collect information and formulate the needed information, (4) ability to find the applicable method to solve the problem, (5) ability to make chronological relation between existing data and selected data, (7) evaluate the logic, validity, and working relevancy.

Working framework of students' critical thinking is developed by accomodating ideas and facts on how student can disclose science knowledge phenomenon, especially energy, and guide the student to understand the science context differently. Ability analysis to think critically, especially for the Science knowledge basic concept in energy, can be seen from several views of interpretation and focus on the problem of critical thinking activity.

In fact, student in field is not skilled in combining different science knowledge context. It is showed that student focus on giving solution by solving the problem mathematically rather than giving scientific substance of the given problem. Ainsworth (2006) states that student's respons consistency in understanding the science knowledge context asks better understanding to see the equality of science knowledge problem which expressed in several ways. The student consistency from science knowledge problem faced may lead the student to better level of understanding.

The importance in facilitating learning of critical thinking ability can be obtained by: 1) discussion, 2) experiment, 3) teacher demonstration, 4) trials, 5) observation, 6) verification of scientific law through experiment, 7) formulating and testing hypothesis, 8) presenting and communicating procedures and research result, 9) documenting scientific activity, 10) identifying and resumung information. The main skill with environtmental study may push student to think critically. Based on theory and observed problem in field, resercher has done there search to examine the consistency of student's critical thinking ability in energy material. Moreover, the problem in this research is "How the Student's Critical Thinking Ability Consistency in Energy Material".

## 2 METHODS

This research is a preliminary study using descriptive research method. Data is obtained by using reasoned multiple choice test, to see the consistency of student's argument. Test items consist of 8 (eight) elements, each item tested is expressed in a verbal form, image, and graphic (or table). The science knowledge material tested is energy. Test item used in this research is a result of content validation from the expert's judgement and also statistical calculation.

The categorization of student to see the consistency of critical thinking ability refers to the student who are categorized as inconsistent if there are two pairs of consistency test are wrong, and are categorized as consistently correct if all given questions test are consistent and correct. Consistency categorization of student's critical thinking ability is assessed by using rubric of critical thinking

ability, modified from Ennis (2015). Data is obtained from 102 PGSD from 3 level University accreditation A, B, and C.

### 3 RESULT

Problem used in the research has been analyzed its validity and reability. Experiment of the item problem to 102 students of 3 level University A, B, and C. regarding the result, it is obtained that the average  $t$ (calculate) 3.01 with  $t$ (table) 2.02 may indicate the validity of the problem set. The reliability of the problem set in a category sufficient contains probability value at 0.43 and the significant level at 0.05.

The percentage the consistency of the students competency are based on the overview on the given answers which are shown at Table 1.

Table 1 Percentage of Critical Thinking Level Students

Level of Consistency	Percentage (%)
Lowest level of critical thinking	45
Middle level of critical thinking	35
High level of critical thinking	16
Very high level of critical thinking	4

Table 1 describes percentage of ability level of students critical thinking which generally show that students have lowest level of critical thinking ability. This implies that students are failed in understanding the problem which has conceptual understanding form.

Regarding the statement above, some students who have the lowest level may be interviewed to explore the problems occurred. The summary result of the interview is that "students may feel common in solving the scientific knowledge based on existing and concepts. Based on the data from research result that has been emphasized by interview result, it needs a paradigm changing by implementing concept integrated with science knowledge to train the students in critical thinking skill.

Regarding Table 1, the percentage categorization of students critical thinking ability is supported with the interview result data from some students who have answer at the three category of critical thinking ability consistency.

Table 2 Percentage of Consistency Level Students

Level of Consistency	Percentage (%)		
	A	B	C
Correctly consistent	18,8	34,6	2,60
Incorrectly consistent	24,7	3,1	38,40
Inconsistent	56,5	62,2	64,50

Students are correctly consistent if they answer and explain correctly. On the other side, students are inconsistent if the answer is wrong but explain a correct reason, vice versa. At the summary, it is shown that students have low level of response ability in applying concepts into literal form by giving competency at the

given answer. The consistency in critical thinking ability asks students in better understanding to oversee the equality between alternative answer and reasoning answer. The tendency of the students to guess the answer is very high. It can be seen that there is no answer that rely to the key sentence of the given problem set.

Ainsworth (2006) states that "students' response consistency in understanding the energy concept needs more understanding of students to see the equality of energy problem that can be state in many ways." Deeper understanding will lead the students to be consistent with what they understand or believes. Even though what students believe are not true due scientific matter, the side effect of consistency of students will lead them to better understanding to view many scientific concept, especially energy, which is put into any kind of problems. Students have been given some problems to describe which water will boil faster viewed from high level. This problem needs correct answer and reason.

Based of the data, students averagely choose answer a, where students give their arguments according to the keywords which are explicitly or implicitly stated at the problem set, which is an object has "various" mass. The stated arguments seem weak. Students should give arguments from the density of the object and the water. This expresses that the students' consistency lie at level 1 (weak).

Related to those conditions, the consistency of students' competency will be categorized as level 1 if students start analyzing from different view at objects which have been determined their position and have the same density with water. Students may assume that object 1 exactly has less density than object 2, and object 3 has greater density than object 2. Therefore, it can be assumed that block 3 will sunk and block will partly float. Regarding "various" object mass, students should directly know the density of object 3 higher than object 2, so that student can conclude that the block 3 will sunk.

The weakness of students in their consistency of critical thinking ability may indicate that the technique delivers science knowledge not in visual. It may influence the energy concept that learned by the students solely base on memorizing. Students also have tendency to prioritize how finishing problems with mathematical equation without understanding the physics substance from each equation used for solving the problems. It affect to the weakness in understanding and mastering the energy material.

The problem set shown at Image 2 is related to the lifting force upward (FA) with Equation  $FA = \rho g V$ . FA is influenced by object's touched area against water. It means the shape of object may influence FA of object. It explains the concept of ship and submarine.

The answer given by students tend to guess and inconsistent. It means that students have difficulties to memorize that the volume of object dipped can be obtained by reducing volume of the water before dipping the object with volume of water after dipping the object. Besides, students have less focus on the direction of the problem set and the answer stem. Student should be able to identify that the volume, type of material, and object density may be assumed equal; therefore if the object mass density are the same, the volume of three object are assumed the same as well.

The ability to analyze the problem may convince students to consistently give reason in each chosen answer. In fact, the option of answer chosen by students are wrong. Meanwhile, the reason are out of the predicted answer that should be written. Low level of ability in understanding the problem set will cause low level of students understanding at an energy concept.

#### 4 CONCLUSION

Based on the research, it is obtained that the average of consistency level of critical thinking ability to incritically consistent, critical enough consistent, and critical, are respectively: at level 4 is 14 students (4%), level 3 is 16 students (16%), level 2 is 36 students (35%), and level 1 is 47 students (45%). Instead of critical thinking ability level, it needs categorization of student consistency in critical thinking ability. The consistency level of students' critical thinking ability only rely on something they know about the task: Sebelas Maret University is 56,5%, State University of Yogyakarta is 62,2%, and Univet is 64,50%. The data shows consistency level of students' critical thinking ability where they are solely involved in critical thinking ability when they find something they know at their task.

It means that students need deeper understanding if the problem set will be given in an abstraction form. This has significant implication on how learning may promote critical thinking ability development.

The consistency development of critical thinking ability is contrast if compared to the scientific concept. Therefore, it results an appropriate discourse, that is a meaningful discussion of scientific spot (a requirement for student who have experience, or understanding about scientific concept).

Basically, students have idea to try to solve the problems but not always succeeded. They try to emphasize their own argument with weak statements. Therefore, students cannot be involved in a competency of scientific concepts and theory if they do not have knowledge background. It does not mean that students do not master many aspect of tasks (or teacher learning) which is not common for them or in abstraction level, but students also struggle to understand one each other as fast as their different construction.

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