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Analysis of Pre-Service Teachers' Reflective Thinking Ability Profile on Earth Physics Lectures

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Abstract – *The purpose of this research is describe the reflective thinking profile of pre-service physics teacher students in Earth physics lectures about Ocean climate. This research was conducted in the physics education study program in one of the Higher Education Institutions in NTB Province, with a total of 25 respondents who had taken the Earth Physics course. The technique used in data collection is the analysis of the physics course syllabus and two essay tests about climate material that integrated with indicators of reflective thinking ability from Dewey's framework. Based on the analysis of the syllabus, it was found that the syllabus applied to the subject of earth physics had not been oriented to the provision of certain skills including reflective thinking skills. In addition, based on data analysis that the average value for question 1 is 18.75 and question number 2 is 16.75 where the maximum average score is on the understanding aspect of 31 for question number 1 while the minimum average score on critical reflection aspect is 7. It means that pre-service physics teacher students have very low reflective thinking abilities in Earth Physics lectures on ocean climate.*

Keywords: *Reflective thinking skills, Earth Physics Syllabus, Earth Physics Lecture*

I. INTRODUCTION

One of the aspects that must be owned by the 21st-century generation is having various skills in order to become qualified human resources so that they succeed in life and career in the world of work. One of the skills that need to be possessed is reflective thinking skills because, these skills are able to connect other thinking skills [1,2]. The preparation of human resources who master 21st-century skills will be effective if pursued through various levels of educational pathways [3,4]. One level of education that must be a concern is the level of graduates, especially LPTK where educators are printed.

During this lecture in teacher education only measures the results and learning achievement [5, 6], there is no lecture process that measures the level of reflective thinking of pre-service teachers in lectures on Earth physics, especially about ocean climate [7]. A lecture that discusses the climate will be educative if someone reflects on the lecture, then find the relationship between the lecture with other knowledge, so that pre-service

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teacher students will find a conclusion with the problem-solving process. Reflective thinking can help change and increase students' abilities in lecturing activities [8]. Without reflection, one cannot be educated from lectures that discuss climate. The ability of reflective thinking can be the basis of the ability to solve various problems, so students can reflect on their experiences to think far ahead to produce ideas of scientific findings [9].

Some developed countries apply problem-solving in reflective thinking explicitly into learning goals and are contained in the physics curriculum, as well as in the curriculum currently being applied in Indonesia, namely the 2013 curriculum. The underlying reasoning is because the problem-solving in reflective thinking can develop cognitive students in general, encourage creativity, develop creative thinking abilities and can motivate students to learn [10, 11]. The ability to solve problems in reflective thinking is a major goal in lectures on Earth's physics about the ocean climate. It is hoped that the pre-service physics teacher students in Indonesia who will become agents of change can play a role in building public knowledge through solving the ocean climate problem.

This research will describe the reflective profile of pre-service physics teacher students in Earth physics lectures about ocean climate. An important question in this study is how to reflect the profile of pre-service physics teacher students on the issue of ocean climate impacts.

II. THEORETICAL

A. Earth Physics

Physics as one of the main pillars of knowledge and technology always develops dynamically in providing an understanding of natural phenomena and their possible application in improving the welfare of human life. In the field of earth, the development of physics related to interactions between humans and nature within the scope of physical phenomena [12,13]. The field of earth physics is indispensable in the exploitation, exploration of mineral resources, water resources, and Earth's material, as well as important in predicting natural disasters caused by humans, issues of global warming, climate change, environmental pollution and so on [14].

B. Ocean Climate

Climate change due to interactions of the atmosphere and oceans is one of the most important global environmental issues facing the world community today. The average annual global temperature on land and sea level increased by 0.85 from 0.65 to 1.06 [15]. The impact of climate change due to the interaction of the atmosphere and the ocean causes an increase in the occurrence of hydrometeorological disasters. Hydrometeorological disasters are disasters

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related to climates, such as whirlwinds, floods, landslides, and drought. The global disaster that occurred between 2008 and 2014 caused 144 million people to be displaced and the disasters caused by climate change [16]. Based on the 2009 disaster data, Indonesia is ranked among the top 5 countries in Asia with the highest occurrence of natural disasters and is dominated by hydrometeorological disasters (Rodriguez, 2009). More than 90% of natural disasters that occur in Indonesia are hydrometeorological disasters that cause a lot of harm to society.

C. Reflective Thinking Skills

Reflective thinking skills are high-level thinking skills that are important to be trained in pre-service physics teacher students in developing problem-solving skills [17] by encouraging pre-service teacher students namely: a) connect new knowledge from prior knowledge, b) think in a way abstract and conceptual, c) apply specific strategies in new tasks, and d) understand their own thinking and learning strategies [9]. Reflective thinking skills are very important in solving climate problems in Indonesia, which are increasingly erratic, sometimes rainy during the dry season and dry during the rainy season.

The application of thinking skills makes teachers as educators motivated to apply it [18]. However, enthusiasm for applying reflective thinking to teacher education has not been agreed upon or agreed throughout the teacher education community about the appropriate reflective thinking component of teacher education programs [19]. However, even so thinking skills are very important to be provided to educators by integrating into various materials or issues that are being studied [21, 22].

III. METHOD

The field study was conducted in July 2018 in the physics education study program at one of the Private Universities (PTS) in NTB Province, with 25 respondents. The instrument used is two integrated ocean climate essay questions with indicators of Dewey's reflective thinking ability, question 1 discusses the phenomenon of atmospheric and ocean interactions, there are warm episodes between December-February and June-August that occur globally in all parts of the Earth and problem 2 about the global phenomena influencing the Indonesian Maritime Continent is the Asian monsoon and the Australian monsoon. Questions on questions consist of four types of measurement of reflective thinking, namely: Habitual Action, Understanding, Reflection, and Critical Reflection. The data obtained are presented descriptively. Some techniques used in data collection are syllabus analysis of Earth Physics courses and tests on students who have taken Earth Physics lectures.

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IV. RESULTS AND DISCUSSION

A. Research Results

1. Physics Education Syllabus Analysis (Bachelor)

The syllabus analysis of the Earth Physics course was conducted aiming to determine the extent to which the ocean climate material was taught to pre-service physics teacher students and to analyze what skills had been provided during the lecture process and how the lecture process was carried out so far.

Table 1. Earth Physics Syllabus

Learning Outcomes	Content Description	Learning approaches
After attending this lecture, students are expected to understand the basic concepts of physics as a basis for knowledge and have broader insights in analyzing everyday phenomena.	In this lecture the earth science in the form of natural phenomena is described, so students are required to play an active role in analyzing the importance of maintaining natural stability	• Approach: Expository and inquiry • Method: Lecture, question and answer, discussion • Task: Report and presentation • Media: Power point transparency, props

2. Analysis of Reflective Thinking Ability Tests

There are two basic questions to measure students' initial reflective thinking abilities about the ocean climate, including questions consisting of four types of reflective thinking measurement: Habitual Action, Understanding, Reflection, and Critical Reflection.

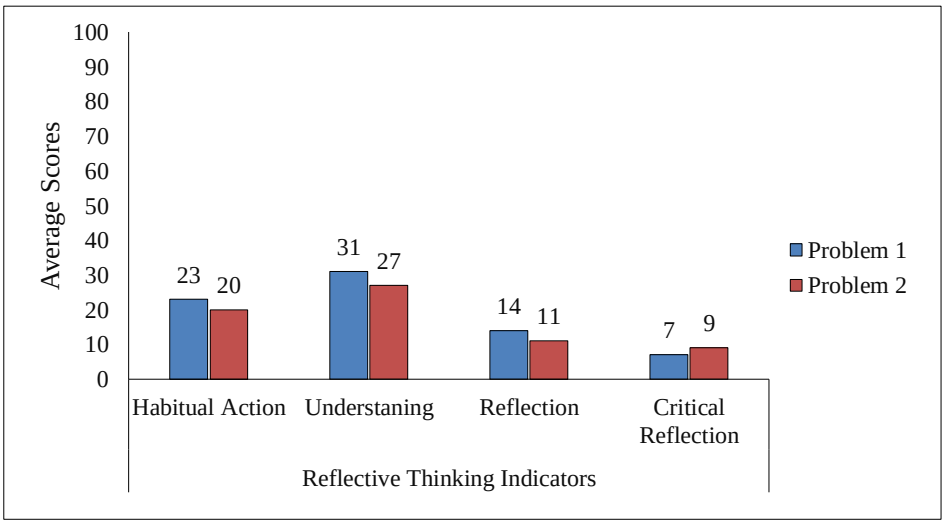

Figure 1. Average Reflective Thinking Ability of Students in Each Indicators

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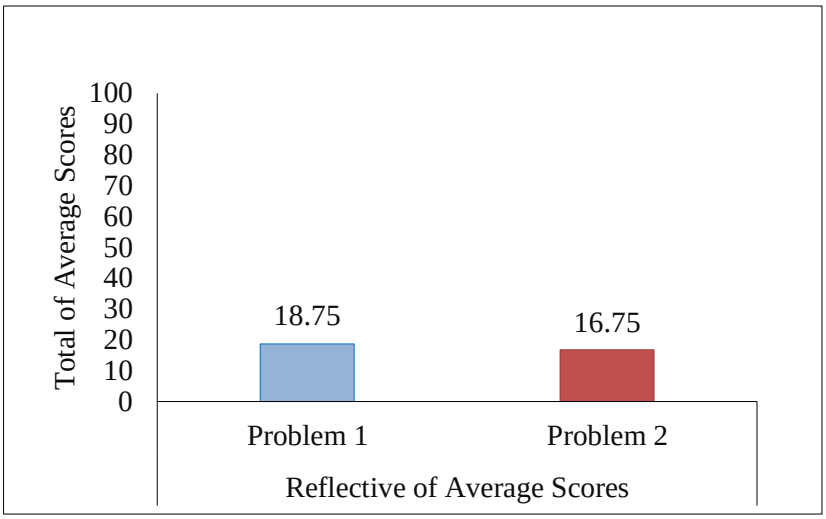

Figure 2. Average Reflective Ability of Student in Each Problem

B. Discussion

Based on the results of the curriculum analysis of earth physics courses in table 1 above, the objectives and description of learning are more about the basic concepts of Earth physics that have not described the findings to solutions to problems about physics, even though one of the indicators of learning in the 21st century is pre-service teacher students trying to provide reasoning makes sense in understanding and making complex choices, understanding the interconnection between systems [1]. Pre-service teacher students also use their abilities to try to solve the problems they face independently, have the ability to compile, express, analyze, and solve problems. The ability to solve problems independently or in groups for self-development including the ability to think reflectively. Likewise, with the learning approach, it can be seen that the approach and method used is not comprehensive because the approach uses expository and inquiry and the method of using lectures, whereas the inquiry approach is learning discovery by means of the teacher guiding students to plan problem solving, helping to prepare tools and materials that are needed and develop appropriate work procedures [22].

Based on Figure 1, it is clear that the students' reflective thinking ability is on average still very low. This can be seen from the average score obtained by each student indicator of reflective thinking ability where the maximum average score is in the aspect of understanding of 31 in problem number 1 while the minimum average score is in the critical reflection aspect of 7 in the number problem 1. Although the average scores of the two indicators of reflective thinking are different, overall the value is still very low as shown in Figure 2 where the average value for question 1 is 18.75 and question number 2 is 16.75.

This shows that the pre-service physics teacher students at one of the private universities in NTB have the ability to think

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highly reflective in lectures on earth physics about the ocean climate. That is because lecturers of earth physics courses never practice reflective thinking skills on students [23-25]. During this time lecturers only convey concepts through presentations and discussions which are then summative evaluated without assessing any skills, so that students' understanding of the ocean climate is very low although basically the concept of the ocean climate is often encountered and is part of everyday life [26]. This is also illustrated from the syllabus of earth physics courses that do not include or integrate any aspect of skills in Earth Physics lectures.

In addition, based on observations that the material on ocean climate has never been taught, lecturers are only limited to conveying the concept of climate in general. Even though climate material is closely related to the ocean climate. Based on research results that around 80% of global climate is influenced by ocean climate [27,28]. Lecturers only give assignments to students to make a summary of climate without any instructions to discuss the ocean climate so that students only make a resume about the climate in general without reviewing material about the ocean climate. The expectation of the Earth physics course at teacher education institutions must reflect 21st-century learning that leads to a variety of thinking skills including reflective thinking skills.

V. CLOSING

A. Conclusions

Based on the results of discussions about issues related to the reflective thinking profile of pre-service teacher students in lectures on ocean climate material in one of the Private Universities (PTS) in NTB province, it can be concluded that the pre-service physics teacher students do not yet have reflective thinking skills, students have good knowledge low to solve and find solutions to problems related to ocean climate and studying ocean climate in Earth physics lectures is still limited information. This has caused the ability of reflective thinking and mastery of the concept of ocean climate is relatively low. Students' expertise in knowing the impact of climate phenomena has not been linked to the process of solving ocean climate problems.

B. Suggestions

My suggestion to solve this problem is that reflective thinking skills and restructuring of the Earth's physics ocean climate material need to be trained to be in line with the needs of the community.

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