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Profile of pre-service biology teachers critical thinking skills based on learning project toward sustainable development

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Abstract. The aims of this research are to describe the pre-services Biology teacher critical thinking skills, based on learning project to build their sustainable development competencies. This research used survey method. The subject was consists of 19 pre-service teacher on 6th semester in one of university in Palangkaraya. The instruments using test Laurent Starkey and questionnaire. The data was analyzed using quantitative descriptive analysis technique. The result show that students critical thinking was low (26%) and lower (74%) categories. The other result showed that the instructional has not led to either project base sustainable development or critical thinking during the class. It is suggested to develop project-based learning toward sustainable development to improve critical thinking skills.

1. Introduction

The goals of learning in university are to provide students with critical thinking skills [1, 2, 3]. Everyone needs critical thinking skills to be successful in solving the problems in difficult situations and having effective and acute communication with others. [4]. Critical thinking skills can help students have a critical view of the problems that occur in society and try to overcome them [4, 5]. Critical thinking skills are the ability to think reflectively and skillfully assess, so students can decide kinds of information that appropriate and kinds of actions should be taken during reasoning and problem solving [6]. The term critical thinking skills refers to many skills such as identifying, analyzing, synthesizing, and evaluating information for decision making, and disposition to apply skills [1, 7, 8, 9,10].

One of the 21st century education goals is to prepare students to understand deep knowledge and apply effective critical thinking skills to cope with the challenges in the ever-changing society [4, 6]. To address the challenges facing the global community, the education system can change the values, attitudes and behavioral patterns to bring about social change [11]. Through education and research students are creatively and critically stimulated to explore the role of sustainable development practices in all areas of human activity in the community [11, 12, 13, 14]. The focus area that can be used to gain the critical thinking skills are toward sustainable development in biological environmental.

Project-based learning is based on a constructive approach as it is designed to motivate students to be more actively involved in learning activities to produce tangible products [15, 16, 17, 18]. Project-based learning provides students with opportunities to learn, develop careers, solve problems, team collaboration, perform creative challenges, provide opportunities to work relatively independently for longer periods, and produce real products, because one of the 21st century skills is to enable students to



collaborate with one another to analyze the problem critically, so as to develop creative ideas to design a real project relevant to the material presented [4, 15, 16, 18, 19].

Some researchers suggest that project-based learning can improve critical thinking skills, because it contain activities refers to interpretation of collected data, predicting results, drawing conclusions, and presenting results [15]. Project-based learning is collaborative in order to improve innovation in generating project tasks [17]. Based on the description, it is important to see the critical thinking profiles on project-based learning toward sustainable development.

2. Experimental method

This study is a survey research at one of the universities in the city of Palangkaraya. The survey involved 19 pre-service teachers of sixth semester. The subjects of the study were taken with the consideration that they enrolled in the marine ecology course. Data critical thinking skills were collected through the standard instrument of critical thinking skills by Laurent Starkey [20] with 10 items questionnaire. The Data analyzed using quantitative descriptive analysis technique.

3. Result and discussion

3.1. Critical thinking skills profile

The result of data analysis shows that profile of pre-service biology teachers' critical thinking skills can be categorized as very low (74%) as shown in figure 1.

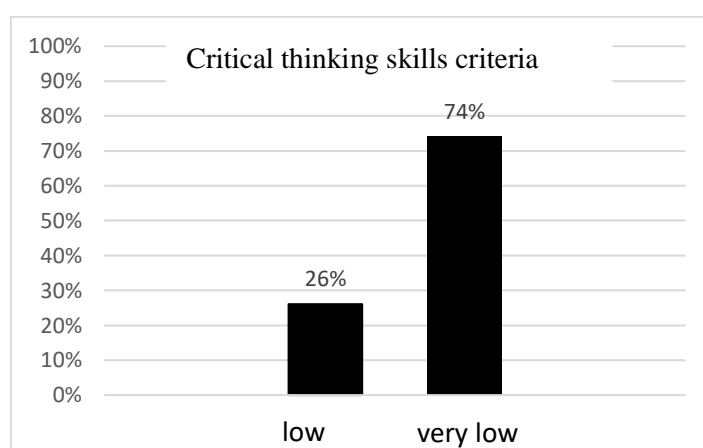


Figure 1. Pre-service teacher's critical thinking skills profile.

Figure 1 shows the 6th semester pre-service biology teachers critical thinking skill at the Tadris Biology Program. As seen on figure 1, there are 26% critical thinking skills with low category that has not been able to answer questions relating to focusing questions, observing and considering observation reports and concluding induction. After that there are 74% students have very low categories in critical thinking skills, because of the inability to answer questions related to the consideration of whether the source is reliable, make deductions, identifies assumptions and determines of an action. No data was found in medium, high, and very high categories so it can be concluded that the critical thinking skills of Biology pre-service teachers are in very low category. Most of subject cannot answer the 3 indicators of critical thinking skills, i.e. build basic skills, conclude and organize strategies and tactics. This finding is in line with previous research results that students have weaknesses in explaining, conclusion and evaluating [6, 21, 22, 23, 24]. To improve critical thinking skills students, four strategies are needed in the learning process that is: enough time to think about problem solving, organize groups to discuss problem solving, presentations to discuss their projects, and reflection exercise [6]. Characteristics of learning methods have an important role to improve students' critical thinking skills required to respond or answer

questions, problems, or challenges, not just to memorize, recognize, and choose the correct answer of the responses [1].

Based on these finding, it can be said that learning has not fully provided critical thinking skills to pre-service biology teacher, university should be provide critical thinking skills and problem solving, because these skills will be needed working in the world 21st century [1]. The 21st century era of globalization people in the world are expected to be able to face the arena of global competition [25].

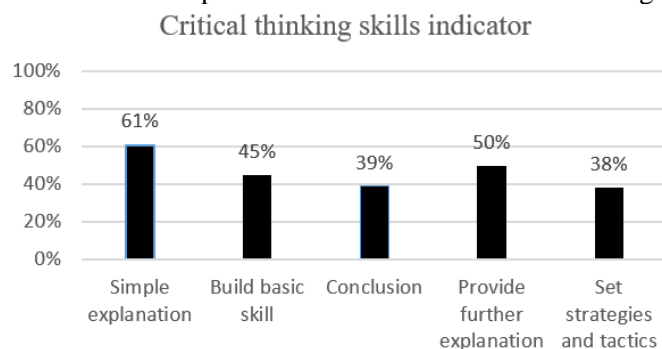
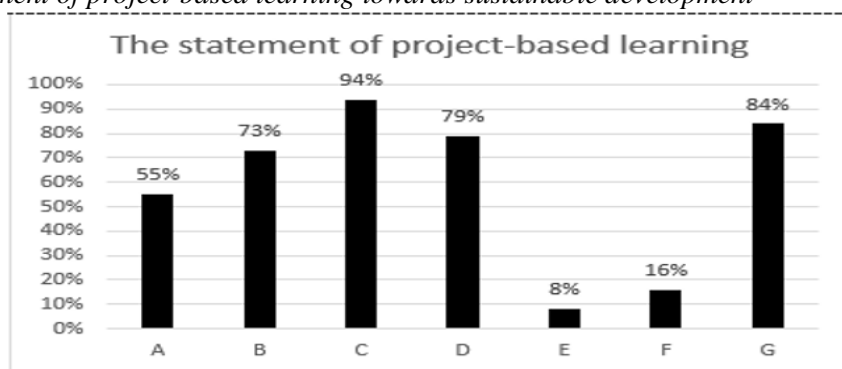


Figure 2. The result of critical thinking skills categories.

Figure 2 shows critical thinking skills pre-service biology teacher using the Ennis framework with indicators [21]: (1) 61% show gives a simple explanation skill; (2) 45% show building basic skill; (3) 39% show concluding skill; (4) 50% show further explanation skill; and (5) 38% show strategy and tactic skill. Based on the data, it appears that there are two critical thinking skills that are more managed, that is giving a simple explanation and provide further explanation.

The result of data obtained is in line with the interview result that the learning so far gives only the task in the form of paper then presented without giving emphasis have not been clear on the concepts. It should not only provoke students through challenging questions to see problems from different perspectives, but also support provide in the form of explaining abstract concepts and facilitating well-organized presentations and opportunities providing for applying concepts and evaluating them. The development of critical thinking skills requires teachers to balance cognitive challenges with intellectual support, as suggested by Sanford (1966) [1].

3.2. The statement of project-based learning towards sustainable development



A; analysis of problems associated with the real world aspect, B; projects in student design or assisted by lecturers aspect, C; the ability to find reference that relate to the project aspect, D; facilitated by campus or personal aspect, E; followed up with the exhibition to get the general public's response, F; utilization of project tasks aspect, G; creative and imaginative to produce a sustainable project show

Figure 3. The statement of project-based learning students towards sustainable development.

Figure 3 shows that the questionnaire given to the respondent aims to find out the extent of the project-based learning process during the course of the environmental biology course. Based on the data analysed the average percentage shown are 58% and it can be interpreted that the response of pre-service biology students with project-based learning to sustainable development is good enough.

Based on the results, the problem analysed aspect on the real world environmental biology material, related to the project task showed score of 55%, it's mean that the respondents stated has not been completely directing the project based on the existing problems. The student's project design were about 73% done by themselves. The data show that make proposals, create teaching materials and 3-dimensional workshops with Styrofoam materials and herbarium are created by themselves.

Aspects of the ability to search for references via the internet and libraries associated with the project task 94%. This data indicates that the respondents have the independence and responsibility to complete the tasks that have been given. Through ICT students can find information in creating products, can also collaborate more effectively, and connect with experts and partners around the world [26,27].

The aspect of working on the project tasks is facilitated by personal (79%). These data indicate that respondents spend more on personal costs than campus facilitation. The project result aspect was followed up with an exhibition to get a general public response (8%). The data indicate that respondents had never done the exhibition. Because result the product from the project task so far only herbarium, proposal, 3-dimensional enzymes model, teaching materials, and soya fermentation, is not a project that can provide economic and social added value toward sustainable development. Aspects the project task utilization to the general public (16%). These data indicate that the resulting product does not provide benefits for real life sustainable.

Aspects have creative power and imagination to produce sustainable projects (84%). This data can be interpreted that respondents have the innovation and creativity to produce project tasks that sustainable increase the economic value of society in a. But talent has not been facilitated in learning environmental biology materials. Aspects of learning about the cultivation of sea urchins and sea cucumbers (0%). This data can be interpreted that none of the respondents have been taught about the cultivation of marine biota. The role of education in global development has a responsibility to challenges the 21st century by fostering values, attitudes, competencies and skills to empower individuals in the current and future economic, social, cultural and environmental sectors, from a local and global perspective toward sustainable development [28].

The findings of this research have implications that project-based learning provides the impetus for analyzing problems and providing solutions by producing sustainable development projects and gaining a pleasant experience. These projects involve critical thinking skills and creative thinking skills through interpretation of collected data, analyzing environmental issues at both the micro and macro levels in relation to environmental sustainability leading to social change, predicting outcomes, providing solutions, drawing conclusions, and presenting results [11,15,19]. The research demonstrates constructivist principles with a project-based convergent model to facilitate collaborative and creative learning to encourage students to study materials related to environmental biology [15, 26].

4. Conclusion

Based on the result of data analysis, it can be concluded that generally the critical thinking skill profile of pre-service Biology teachers are categorized very low. In addition, the response of students with project-based learning towards sustainable development is quite good. Project-based learning taught so far has not resulted in a project task that is beneficial to the community in a sustainable manner nor has the exhibition ever done to get a response from public generally. Project-based learning into sustainable development can be used as a reference in developing the design of learning activities to improve critical thinking skills. The learning process can be organized and conditioned on learning situations by analyzing problems and making decisions so as producing real projects useful for social change towards sustainable development. On the other hand, developing critical thinking skills is an essential skill that must be possessed by prospective biology teachers.

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