Preparation of the Next Generation Science Teacher: A Case in Applied Science Course

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Abstract. Our next generation will be facing a world full of challenges, different from ours. It is also a challenge for us to prepare them to face it. Especially in the field of science teaching, we are required to provide interesting learning methods that meet the needs of the next generation. This paper provides an overview of the application of one of the learning methods to prepare the next generation science teachers. The learning was conducted in six main steps: introduction, enhancing the concept, forum group discussion I, applying the theory, forum group discussion II, and evaluation. The learning was conducted in applied science course in the Department of Elementary School Teacher Education, University of Djuanda Bogor. Result showed that this method train student to be directly involved in solving various natural problems around them. This kind of learning is learning that is needed by the next generation students.

Keywords: science teacher, applied science, project-based learning

1. Introduction

The future citizen requires more than knowledge of the basic concepts of science, but also a vision of how such knowledge relates to their environment and other events, why it is important, and how this particular view of the world came to be. Any science education, therefore, which focuses predominantly on the intellectual products of our scientific labour — the facts of science — simply fails to offer what is required [1]. The phrase that is commonly used to embody this vision of science education is that we should provide an education for scientific literacy and producing a way or method to solve any scientific problem in our environment [2].

Learning science in the 21st century requires us to be able to present meaningful learning. Learning in class is expected not only to produce theory, then students do not care about the natural conditions in their environment. Learning science should be able to train students' sensitivity to their natural conditions and about the various problems that exist in it and can produce solutions to these problems so that the sustainability of nature in the future can be maintained.

This study aims to provide an overview of one alternative science teaching method that can be applied in preparing science teachers for the next generation students. This study provides advice on how to prepare science teachers for elementary school students so that they can guarantee the sustainability of nature for the future [3].

The rest of this paper is organized as follows: Section 2 describes the proposed research method. Section 3 presented the obtained results and following by discussion. Finally, Section 4 concludes this work.
2. Method
This study is the application of six steps learning method in applied science courses. The instrument used is an open questionnaire about the opinions of students in attending lectures. The findings are reviewed qualitatively. The research subjects were students in one class consisting of 28 students in the Department of Elementary School Teacher Education in the fifth semester of Djuanda University Bogor 2018. This study was conducted in one semester.

3. Results and Discussion
Applied science course was conducted in six main steps learning method: introduction, enhancing the concept, forum group discussion I, applying the theory, forum group discussion II, and evaluation.

3.1. Introduction
At this step, lecturers lead the class to discuss current science topics and are close to daily life. The lecturer started the class discussion by presenting problems on several topics including clean water, hydroponics, addictive substances, additives substances, and compost. The topic is then taken as a focus topic that will be used as a discussion material in the group. The lecturer then divides the class into 5 groups for each of them to deepen the topics that have been explored in the beginning.

3.2. Enhancing the concept
As many as 28 students were divided into 5 groups consisting of 5-6 people in each group. Each group then discusses one topic through deepening the study of literature, related theories and related concepts, as well as exploring problems around their environment regarding the topic they chose. The results of the literature study of each group are presented in a report and made as a class discussion material.

3.3. Forum group discussion I
At this step, students present the results of the literature review report into a forum group discussion. Each group alternately presents the results of the literature review. Other groups provide responses and suggestions or questions.
Students look enthusiastic in exploring related theories and related concepts. The group who discussed about clean water presents the concept of clean water and several techniques used to produce clean water. They also surveyed the condition of water in several places around their homes. The group that discusses hydroponics presents various methods that can be used in hydroponic farming. The equipment and materials needed are also reviewed and calculated financially. Groups discussing addictive ingredients, such as groups that discuss addictive ingredients, they present theories and classifications of some of these ingredients. While the group discussing agriculture presents a discussion on compost fertilizer, which is related to materials and methods to produce good and simple compost. They present this study after surveying the problems around them.
The forum group discussion ends with a project plan that they will do to solve the problems they find around them, of course they adjust the project to the theory that has been studied in the forum group discussion I.
At this step the lecturer acts as a facilitator. Lecturers lead forum discussion groups and give suggestions and responses.

3.4. Applying the theory
The project plan that was discussed in the first forum group discussion was carried out at this step. Based on the study of the literature they have covered and the project plans they have presented, the implementation of the project to solve problems in their surrounding environment can be carried out properly. The project they designed must first be approved by the lecturer before being implemented. Lecturers give around 2-4 weeks for them to carry out the project. During the
implementation of this project, students do not need to be present in class but are allowed to discuss the implementation of the project to lecturers outside the classroom. The clean water group carries out a project on simple techniques to clear water so that clean water can be produced from dirty water. They carry out this project to overcome the problem of the difficulty of clean water in the areas they meet. They have found that there are water sources with normal pH but the water is cloudy and dirty. The water purification method they are trying to apply is filtering water with several layers of material such as rock, sand, palm fiber and charcoal as adsorbents. Some of these materials are arranged in medium-sized paralon pipes and can be applied on a household scale. Then they applied this simple technique to several residents' homes so that they could overcome the problem of difficulty getting clean water [4].

Hydroponic groups carry out hydroponic planting projects with Wick System and Water Culture System techniques. Both of these techniques were chosen because they are easy to apply on a household scale. Materials and equipment are easily available. They plant mustard with both techniques and then compare the development of the two plants for a certain period [5]. The results of the project show that planting mustard with the Wick System technique provides better and more results seen from the number of leaves, leaf width, and rod strength produced. Some members of the group continued to plant this hydroponics as an effort at home.

The group that discussed additive materials carried out the project in the form of a survey of additive materials in foods found in stalls in several primary schools. The results of their projects show that there are still many food vendors using hazardous additives. A number of elementary school students also surveyed said they did not know about food additives that are harmful to health. The results of this project suggest that socialization can be made about food additives to food traders and elementary school students.

The group that discussed additive materials carried out the project by providing counseling to elementary school students about the dangers of addictive ingredients. They also explained about various addictive substance abuse that often occurs. They carry out this project to avoid elementary school students from the dangers of addictive substance abuse. The elementary school students they visited seemed enthusiastic and happy to receive new explanations about things they didn't know much.

While the group that discussed about agriculture carried out the project about making compost with many materials available around their environment. Two types of compost were tried to be made in this project, namely compost from dried leaves and compost from goat manure. The project results show that compost from goat manure is faster than compost from dried leaves.

3.5. Forum group discussion II

At this step student return to class to discuss each project they have carried out. Students show the results of the project in the form of the tools and methods they use, the results of the project, as well as an explanation of the various support and constraints they encountered during carrying out the project. Each group presents a discussion about their project and another group responds to the project results. At this step the lecturer continues to act as a facilitator who heads the forum discussion group.

3.6. Evaluation

Evaluations are carried out by lecturers to test each student's understanding of the projects they have done and other group projects. At this step the lecturer also challenges students to be able to provide other solutions to various problems, apart from the projects that have been implemented [6]. Learning with this method is expected to provide interesting experiences to students about teaching science. Teaching science for next generation students cannot be done by teaching about theory only. Students must be sensitive to problems in their surroundings. Teaching science is teaching about how to provide solutions to problems about science by applying various concepts and theories they learn. Teaching science is teaching to conserve nature for the sake of survival in the future.
4. Conclusion

Teaching science is teaching about how to safeguard natural sustainability in the future. Preparing a good science teacher for the next generation can be done by training them to be sensitive to environmental problems and provide solutions to these problems.

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