Simple webs of natural environment theme as a result of sharing in science teacher training

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Abstract. Thematic learning is one type of integrated science (Biology, Physics, Chemistry and Earth Science) in Science Education. This study is concerning about simple webs of natural environment theme in science learning, as one of training material in science teacher training program. Making simple web is a goal of first step in teacher training program. Every group explain their web illustration to other group. Twenty Junior High School science teacher above one education foundation participate in science teacher training program. In order to gather simple webs, sharing method was used in this first step of science teacher training. The result of this study is five different simple web of natural environment themes. These webs represent science learning in class VII/Semester I, class VII/ Semester II, Class VIII, Class IX/ Semester I, Class IX/ Semester II based on basic competency in National Curriculum 2013. Each group discussed web of natural environment theme based on their learning experience in real class which basic competency and subject matters are linked with natural environment theme. As a conclusion, simple webs are potential to develop in the next step of science teacher training program and to be implemented in real class.

1. Introduction

In science education, Junior High School student learn how to think integrated between Biology, Physics, Chemistry and Earth Science, known as Integrated Science. Thematic learning is one type of integrated science and from thematic learning, students learn better than from a single-subject curriculum [1]. It help students to think in integrated way and enjoy learning science. Science teacher play an important role in science learning improvement by planning their learning thematically [2]. However, science teacher have to master all science concepts especially concepts within a theme, as a part of professional competency improvement. Science teacher training program can be a good solution to improve science teacher’s professional competency. Making webs for natural environment theme collaboratively among science teacher as participant is one step of science teacher training program.

This study is focused on Natural Environment theme of all science concepts in Junior High School based on current Curriculum. Natural Environment theme’s webs are interesting to investigate in this study and become the goal of this study. The reason of choosing Natural Environment theme is Natural environment closely related to our daily activities and its complexity. Simple webs of natural environment theme in science learning, as a part of training material in science teacher training
program, become a concern of this study. Result of this study is used as a foundation for another step in science teacher training program and science learning in real class.

2. Methods

The procedure of this study is described in Figure 1. The subject of this study is 20 science teacher under Catholic Education Foundation in Bandung. They participate in science teacher training program in December 2016. In first step of science teacher training program, the class is divide into five groups. This study begin with exploration of participant’s idea about science basic competency and matter that related with environmental concepts. Collaboratively, each group make a simple web based on environmental theme that discussed before. There are five webs, each represent environmental theme in Class VII/Semester I, Class VII/Semester II, Class VIII, Class IX/ Semester I and Class IX/Semester II. After making a web, each group present their simple web to class. With sharing ideas and web between participant, participant will enrich their knowledge about natural environment theme in integrated science. Data is analysis qualitatively based on simple web that represented by participant.

![Figure 1. Study procedure](image)

3. Results and discussion

3.1. Class VII

According sharing between participants, there are two basic competency in Class VII semester I linked with Natural environment theme. As we can see in Figure 2, three subject matter include in Basic Competency (BC) classification of living things, they are the characteristics of living things, classification of living things and the organizational level of life. Classification relate with natural environment because it can integrate diverse, character-based data in a phylogenetic framework, which allows a broad user community to utilize the disparate knowledge of shared biological properties of taxa. There are two major kingdom based on classification of living things, the prokaryotic kingdoms Archaea (Archaebacteria) and Bacteria (Eubacteria) and the eukaryotic kingdoms (Protozoa, Protista, Fungi, Plantae, and Animalia) [3]. Based on participation’s perception, the living things live in nature environment as a reason why classification of living things linked with nature environmental theme.

The second basic competency that linked with Natural Environment theme is Energy in the life system. There are three subject matter in basic competency Energy in the life system (Figure 2), energy and energy sources, energy change in nature and in body and photosynthesis. For example, combustion of Methane (CH₄) produce lower carbon dioxide [4] and reduce air pollution. Another research show that municipal solid waste can generate energy [5] and environmental friendly. In nature environment, there are some potential source of alternative energy. Wind power can generate electricity, which is less polluted than fossil energy [6]. In cellular level, sunlight is source of energy during photosynthesis in plant [7]. Plant play an important role in natural environment because plant release Oxygen after photosynthesis process.
In Figure 3, there are four Basic Competency/subject matter linked with Natural Environment theme, Interaction between living creatures and their environment (BC 3.7), Environmental pollution (BC 3.8), Climate change (BC 3.9) and Disaster mitigation efforts (BC 3.10). These basic competencies relate each other. Climate change can affect interaction between living creatures and their environment. Recent study show that wildfire, as an impact of climate change, can have a tremendous impact on forest ecosystem [8]. Interaction between climate, soil organic matter and above living biomass can ease forest fire. Climate change also affects marine ecosystem. Coral reefs threatened by a variety of climate-related changes, rising sea temperature and acidification [9].

The presence of excessive gases like CO$_2$, CH$_4$, N$_2$O, certain industrial compound and humankind’s activities contribute to greenhouse effect [10] and environmental pollution. Over years, the pattern of climate change caused by future changes in atmospheric concentrations of greenhouse gases. In order to overcoming climate change, it is essential to set strategies for mitigating the effects of climate change on ecosystem services [11]. A research shows how climate change affect crop yields in plant growth and production [12].

3.2. Class VIII
Based on participants’ sharing in this first step of science teacher training program, four subject matters are chosen within natural environment theme by participants (Figure 4): plant structure, addictive substance, tissue capillarity and respiration. A research shows that plant root play important role in nutrient uptake and soil environment [13]. Another research shows how plants depend on environment especially environmental weather/growth conditions [14]. Tissue capillarity and plant structure closely related each other because nutrients are transported to all parts of the plant based on the principle of tissue capillarity.
According to participant's opinion, addictive substance in cigarette and cigarette smoke can disturb human's respiration and cause air pollution. It is the reason why they put addictive substance and respiration into web (Figure 4). A study shows that long exposure of cigarette smoke cause pulmonary disease and impair lung function [15]. In sharing session, participants give connection that in healthy natural environment, there must be sufficient plants and healthy air.

### 3.3. Class IX

In Figure 5 (a), there are four BC in Class IX semester I that link with natural environment theme: reproduction, natural selection, biotechnology and alternative energy. A research about selection system in Norway spruce forest shows that heavy harvest can affect natural selection system and forest growth, in spite of damage caused by wind and snow [16]. Biotechnology can be used to see ecological meaningfully bacterial association in paddy soil [17], apply interaction between microorganisms and create artificial conditions that exist in natural environment, in order to improve rice yields.

Some research are also focused on alternative energy. Biomass from plantation or semi-natural forest in Sweden harvested for bioenergy [18]. Harvesting biomass can be a good solution for environmental friendly energy and a good potential for alternative energy, sustainable forest. In Australia, wind and Photovoltaics dominate new source of alternative energy and replace coal generator [6]. As we know, the emission from coal generator (CO$_2$ and SO$_2$) cause air pollution. So, alternative energy should be environmental friendly.

Three BC in class IX semester II (Figure 5 (b)) are linked with natural environment theme: Apply Biotechnology concepts and its role in human's life; connect soil's physical and chemical properties, living organism in soil with importance of soil for sustainable life; analyze environmental friendly technology product and process for sustainable life. Healthy soil give positive impact to promote yields and for biota to support nutrient cycling, decomposition [19]. In the term of environmental friendly technology, a research shows that phytoremediation is one kind of technology to remedy the polluted environment [20].

![Diagram](image.png)

**Figure 4.** Natural environment theme for class VIII
4. Conclusion
From the comprehensive result and discussion, natural environment theme in integrated science can help science teachers in teaching integrated science (Biology, Physics, Chemistry) in junior high school. From these simple webs, science teacher can develop more complicated web to see more detail about Biology, Physics, Chemistry concepts that are included in natural environment theme and implement it in real class. Student become more challenged to learn science because of they know what theme they will learn. Finally, making simple web for thematic learning in this research is used as a starting point for integrated science learning development.

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