

S -07

LEARNING SCIENCE ORIENTED PEDAGOGY FOR SUSTAINABILITY TO BUILD THE CONCERN FOR THE ENVIRONMENT

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ABSTRACT

This study aims to study the application of science teaching oriented pedagogy for sustainability.

Until the era of the 21st century , human behavior to care about the environment has not been fully realized. This is demonstrated by the fact that lead to the exploitation of natural resources without thinking of the current generation and future . This fact becomes a big idea in changing human behavior that lead to sustainability of life in this universe. Education plays an important role in the generation of human quality to build the characters, cognitive, and skills. Concern for the sustainability of natural resources into the urgency of the moment. Education that leads to sustainability of resources and the environment need to be inserted and integrated course in science. Model of teaching based sustainability can be integrated in the natural science. Object of natural science are the phenomenon in physical, chemical, biological and related to technology, environment and society. Understanding of student science content will be used to analyze and troubleshoot the issue at hand. In the process of analyzing and solving problems, the necessary scientific literacy and thinking skills.

Attitudes and actions toward sustainability principles can be implanted through a model of pedagogy that emphasizes the activities in explore, discuss, investigate, plan of action is beneficial and does not have a negative impact on future generations. The approach can be used is real world learning, problem-solving and critical experiential (active) learning. This approach is applied to achieve sustainability competence includes four competencies : (1) system thinking and understanding of interconnectedness, (2) longterm , foresighted reasoning , and strategizing, (3) stake holder engagement and group collaboration, (4) action orientation and change-agent skills.

Keywords : learning science, pedagogy for sustainability, sustainability competence.

Introduction

Until the era of the 21st century , human behavior to care about the environment has not been fully realized. This is demonstrated by the fact that lead to the exploitation of natural resources without thinking of the current generation and future . For example, there are many people who throw trash out of place , inaccuracies in waste management, perform behaviors that increase the accumulation of CO₂, energy using without thinking about renewable energy innovation, the use of textile dyes for food additives, improper diet , and so forth. This fact becomes a big idea in changing human behavior that lead to sustainability of life in this universe .This is important in the sustainability of resources for future generations.

Education plays an important role in changing the behavior of students so as to produce better learning outcomes overall cognitive, psychomotor and attitude. Aspects of attitude into the substance of the moving positive human behavior. Concern for the sustainability of natural resources into the urgency of the moment. Education that leads to sustainability of resources and the environment need to be inserted and integrated course in science. Learning based sustainability can be integrated in the science. Science examines the phenomenon of remembering objects and natural phenomena in physical, chemical, biological and related to

technology, environment and society. It is appropriate that reflect the nature of science issues holistically in real life. Science (natural sciences) can be studied from several aspects: as a science building (body of knowledge), a way of thinking (a way of thinking), how investigations (a way of investigation) and its relation to technology and society.

To be able behave and act oriented sustainable development, learners need to master the science content on emerging issues. Mastery and understanding of science content students will be used to analyze and decide on the issue. Furthermore, the ability and the habit of thinking on the issue of sustainability form a caring attitude towards nature and its contents.

Science teachers need to be prepared to master interdisciplinary science. Science teacher must master the appropriate standards set forth in the NSTA. NSTA (2003 : 1), recommending standards for science teacher preparation. This standard contains a number of standards that must be possessed by the teacher includes standard content, the nature of science, inquir, issues, general skills of teaching, curriculum, science in the community, assessment, safety and welfare, professional growth. This standard is consistent with the vision of NSES (National Science Education Standards). NSTA (2003 : 8) in Insih Wilujeng (2010: 353), also recommends that the science teachers of primary and secondary schools should have the capability of interdisciplinary science.

In the 2013 curriculum stated that science teaching in junior high schools implemented based integration. Science teaching in junior high school was developed as integrative science subjects rather than as educational disciplines. Both as an applicative oriented education, the development of thinking skills, study skills, curiosity, and the development of caring and responsible attitude towards the natural and social environment. Integrative science has meaning which combines various aspects of the domain of attitudes, knowledge, and skills. In substance, the science can be used as tool to develop the attitude, knowledge and skills domain. Science must be teach to build attitude concern to environment sustainability.

Attitudes and actions toward sustainability principles can be implanted through a model of pedagogy that emphasizes the information-seeking activities, explore, discuss, investigate, plan of action is beneficial and does not have a negative impact on future generations. According to Erin Redman (2013 : 6), approaches that can be used is real word learning, critical problem solving and experiential (active) learning. Based on identification of the problem, the problem can be formulated as follows: How to apply science learning-oriented pedagogy for sustainability? This study aims know the way to apply science instruction that oriented pedagogy for sustainability.

Discussion

Pedagogy for Sustainability

Brundtland (1987, in Holbrook, 2009: 47) describes sustainable development as follows: " sustainable development is development that meets the needs of the present without compromising the ability of future generation to meet their own needs". It means that sustainable development is in accordance with human needs today without compromising the needs of future generations. This means that in carrying out the construction at this time should be taken into account if this development does not harm the future generations.(Paul Suparno,2012:8).

John McMurtry (2001) on Holbrook (2009: 47), a philosopher explained that sustainable development related to the development of civil commons, common needs, where everyone in the community can access the required necessities of life, so that everyone can flourish and express themselves as human. Needs of the general public, among others, education, health, legal environment, health and safety rules, as well as the general release (Paul Suparno , 2012: 9.).

Sustainable development has three important perspective namely socio cultural, environmental and economic ((UNESCO, on Puslitjak, 2010: 12): a) Socio cultural perspective is an understanding to social unit and human role in change and development, b) Environmental perspective is an awareness of the natural resources, the physical environment, the impact of human activities, and decision making related to the commitment to create social and economic development policies, c) Economic perspective is the sensitivity to the limitations and potential of economic growth and its impact on society and the environment.

Approach oriented sustainability emphasis in guide student to think about sustainability for future generations . This is a concern to think the positive and negative effects for the next natural users. In order to maintain this nature , the necessity of caring attitude are integrated through science learning.

Sustainability Comptence

According to Erin Redman (2013:4), "competence refer to concept and skills that enable students to understand and resolve complex sustainability problems and tasks". Competence in sustainability includes four competencies as proposed Eridn Redman (2013:4-5) : (1) system thinking and understanding of interconnectedness, (2) longterm, foresighted reasoning, and strategizing, (3) stakeholder engagement and group collaboration, (4) action orientation and change -agent skills. That can be abstracted in terms of competence systems thinking, students are expected to have apply thinking competence and conscious about the effect, reduces the effect. In systems thinking is not just talking about the effect but to look for or seek out linkages that occur in the home, classroom and school. After the process of thinking about the effects, further competence is predicted to think towards the future and plan to think and formulate strategy. At this point emphasize that the actions taken today have consequences for the future in the long term. The next competency is the ability to influence and make an agreement within the group. To realize the sustainability is required collaboration. Students need to be facilitated with the skills and resources to participate in decision-making to view the past, present and the future. Students can be assigned to interview the family environment and industry on an issue. The last competence is act to good behavior both individuals and group. Facilitating students use the skills and confidence to take action for the future.

Learning oriented Pedagogy for Sustainability

Pedagogy is a way to teach that integrate sustainability teaching competence. According to Erin Redman (2013: 6) , a method that can be used is real world learning, critical problem- solving and experiential (active) learning. A model of sustainability pedagogy to achieve competence can be shown below:

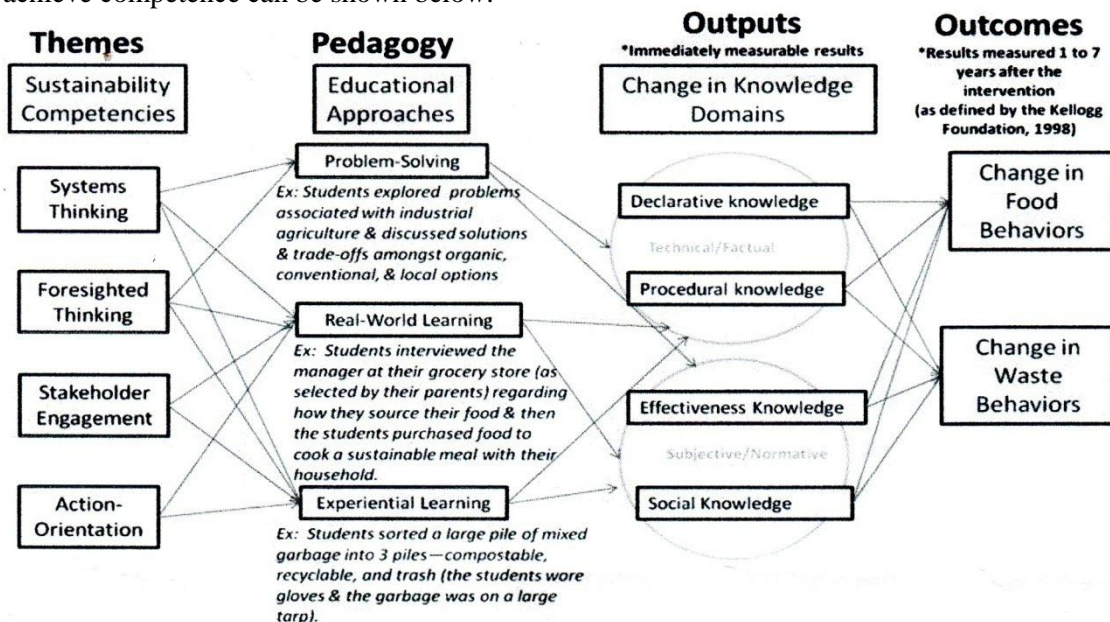


Figure 1. Approach for Targeting Behavior Change Outcomes

Pedagogical approach that use problem-solving methods directing students to explore the issues in the environment , for example in the agricultural, industrial and other issues. Furthermore, through discussion, students are directed to solving the problem based on problems found. To guide the direction of the principle of sustainability can also be done by real-world learning or learning in the world or real life. In this case, students are encouraged to observe, ask questions, conduct interviews on an object that is the source of the problem. Approach to experiential learning can be done by getting students to perform a direct, for example to process waste into compost, recycling bins.

Science Instruction

Koballa and Chiappetta (2010: 105), defines science as a way of thinking, a way of investigating, a body of knowledge, and its interaction with technology and society. Can be summarized that in science there are dimensional way of thinking, a way of investigation, and building science related to technology and society . This becomes the substance of the importance of learning the underlying science that develops scientific process for the formation of mindset learners. According to Sund and Trowbridge (1973: 2) , the word science as " both a body of knowledge and a process ". Science is defined as the science of building and process . Furthermore, science has defined three key elements,namely;attitudes,processes and products.

Science has three major elements : attitudes, processes or methods, and products. Attitudes are certain beliefs, values, opinions, for exampl , suspending judgment until the data has been collected enough relative o the problem. Constantly endeavouring to be objectives. Process or methods are certain ways of Investigating the problem , for example , making hypotheses , designing and carrying out experiments , measuring and evaluating the data . Products are facts , principles , laws , theories , for example , the scientific principle : metalswhen heated expands (Carin & Sund , 1980: 2).

Science has a holistic object and issues that need to be presented in a holistic science. According to Hewitt , Paul G and etc (2007 : xvi) , integrated science presents aspects of physics, chemistry, biology, earth science, astronomy and other aspects of natural sciences. In this concept, integrated science presented based contextual approach which connects science with everyday life. This approach putting one of the key ideas that contained problem solving. In the teaching, the science is presented with a unitary concept.

According Trefil , James & Robert Hazen (2007 : xii) , an integrated approach involves the scientific process, organizing principles, organizing the natural integration of scientific knowledge and its application in daily life. In an integrated approach, student is also expected to be able to link in other fields include physics, astronomy, chemistry, geology, biology, technology, the environment, health and safety.

In instill attitudes and actions toward sustainability principles (sustainability), learners must have scientific literacy and thinking skills. Scientific literacy and thinking skills will be used in decide and respond to a variety of scientific problems in later life. And then may lead to think and decide what is good for the sustainability of nature . Scientific literacy is derived from the combination of two latin words which means **literatus** marked with letters, literate or educated and **scientia**, which means to have knowledge . National Science Teacher Association (1971) suggested that a person who has scientific literacy is a person who uses scientific concepts, have science process skills to be able to assess in making daily decisions that he relates to other people, the environment, and to understand the interaction between science, technology and society, including the social and economic development. Science literacy defined as well as the capacity to use the scientific knowledge, to identify questions and draw

conclusions based on facts to understand the universe and make decisions on changes that occur due to human activities (OECD,2003).

The ability to think and character has an important role to form the critical and morals learner. Thinking skills will equip students in analyzing problems in life, critiquing problems with reasoning to be used in making good decisions. Think activity is reasonable activities to cultivate the knowledge that has been gained through the senses to obtain the truth. Furthermore, scientific thinking is defined as follows :

Scientific thinking is defined as the application of the methods or principles of scientific inquiry to reasoning or problem - solving Situations , and involves the skills implicated in generating , testing and revising theories , and in the case of fully developed skills , to reflect on the process of knowledge acquisition and change (Koslowski , 1996; Kuhn & Franklin , 2006; Wilkening & Sodian , 2005)

The ability to think will lead the student reason ability were able to observe a variety of phenomena and problems, linking the cause and effect and then the students can decide wise and positive decisions that attention to a concern for the sustainability of this nature.

Conclusion

Attitudes and actions toward sustainability principles can be implanted through a model of pedagogy that emphasizes the information-seeking activities, explore, discuss, investigate, plan of action is beneficial and does not have a negative impact on future generations. The approach can be used is real world learning, critical problem solving and experiential (active) learning. This approach is applied to achieve sustainability competence includes four competencies : (1) system thinking and understanding of interconnectedness, (2) longterm, foresighted reasoning, and strategizing, (3) stakeholder engagement and group collaboration, (4) action orientation and change -agent skills .

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