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A Concept: Enhancing Biology Learning Quality by Using Process Image

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ABSTRACT

Biology learning cannot be separated from visual activities which a part of process skill approach. Visual activities involve process and supported by images. Meanwhile, the images are something that can depute real objects and have the same character of colours and shape as the original. The process is a series activities which take place gradually and continuously to achieve a goal. As for 'process image' is the series of pictures which visualise a phenomenon or a natural fact, so that students can understand the concepts and theories of biology that deals with the pictures. This paper aimed to describe the role of 'process image' to enhance High Order Thinking Skills (HOTS), retentions, process skills and learning achievements. The method of this research was analysed from some international journals about the effectiveness of process pictures in the Biology learning. Media of process image has many advantages in a visualisation of abstract concepts in the biology learning..

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INTRODUCTION

The process of biology learning in Indonesia showed that teachers were more inclined to explain and provide information regarding the phenomenon and concepts in Biology verbally and not through real life observation, having a tendency to explain topics, provide samples of questions, and give exercises. In daily practice, teachers did not give the opportunity to the students to observe their surroundings in order to show the biological phenomenon, nor to see the basic concepts through instructional

media and observation. Student's responses towards this teaching are primarily in the form of revising information given by the teacher. Teachers are primarily "subject matter oriented only", focusing on the discussion of content without the consideration of students learning (Depdikbud, 2005; Suryawati et al., 2010; Yustina et al., 2011).

Biology learning can not be separated from observation activities as one of Science Process Skill Approach. Science process skill approach is an intellectual and practical skill that is learned and developed for students during the learning process. This approach includes 5M (observing, questioning, associating, experimenting, and networking). The target of science process skill approach is achieved by using the media. Varied instructional media that used in learning are audio, visual, and audio-visual. Visual materials such as images or pictures make a crucial role to improve knowledge and learning processes. Thus, the appropriate supporting media is visual media. Visual materials like images have an important role for improving knowledge and learning process (Rokni & Neda, 2013).

The success of learning process is determined by observing. In fact, students have not been fully able to observe properly. Observing based on certain process and assisted with the visual media (images), so that students can choose the important concept that related with material and it can be saved on long-term memory.

Studies of importance of images and process in learning process have been widely practiced. Images also help students to create relationships between words, provide more detail, shows more knowledge, responsiveness, awareness of the objects, and situations or text that can be communicated. Canning and Wilson (2001) also point that images can help the student to work with more abstract thoughts and organizing skills through the use of a logical structure.

Basically, images and process can not stand by itself. It has to pair to realize the effective and efficient learning because of images only shows a form of monotone visualization. However, the Process Image is defined as a series of images or pictures of modeling object, events, or phenomenon, which are relative to their state, position, shape, or combination as a whole illustrates and coherent stage (Sutarto et al., 2016). Thus, the process image is able to visualize a state related to science concept in systematicaly.

This study aims to examine the role of Process Image to improving the ability of high order thinking skill, retention, and students learning achievement.

METHODS

This paper analyzes several international journals that related to the effectiveness of Process Image in Biology learning process.

RESULTS AND DISCUSSION

The Importance of Process Image to Enhance Science Process Skill Approach

Science process skill approach is an intellectual and practical skill that is learned and developed for students during the learning process (Balfakiha, 2010), to make the students ready to encounter the 21st century challenges. Ausubel (1968) argues that science process skills such as measuring, observing, classifying, and predicting are essential for understanding scientific concepts and propositions for meaningful scientific procedures for problem-solving and their application in life. Achieving the target of science process skills approach required the existence of media. One of the supporting

media is visual media.

Visual media is very important for education system and it is used in classroom to support the learning process and make it easier and interesting. Visual media aids are the right tool to disseminate knowledge.

Visual aids are important in an education system. Visual aids are those devices which are used in classrooms to encourage students learning process and make it easier and interesting. Visual aids are the best tool for making teaching effective and the best dissemination of knowledge (Shabiralyani et al., 2015).

The images make a real idea, through the visualization of abstract things became concrete. It can be said that images are partnered with an unspoken word. The verbal analysis is an aid to understanding what the eye sees. Discussion and debate build language competence, critical thinking, and interpersonal skills as students hear and share ideas with other classmates (Bull & Lynn, 2005).

Therefore, the process also needed for images development as visual media. Process is a series of steps related to how it works to completion. Images and process can not be separated. Thus, process image is a series that visualized phenomenon or natural events so that students can understand the concepts and theories of a material related to the pictures.

Perhaps one of the most extensively investigated of these differences is known as the picture superiority effect, which is the finding that items presented in picture format are better remembered than those presented in word formats (Nelson, Reed, & Walling, 1976; Stenberg, Radenborg & Hedman, 1995).

With the use of pictures, the meaning of the word is expanded beyond plain text recognition and processed along more than a single acoustic store as would be the case if words were presented without a picture. Thus, the pairing of pictures with words helps establish multiple connections between the verbal and non-verbal representation of a word (Hazamy, 2009).

Learning process using science process skill approach is designed for the student whom they can find some facts, find then build the concept and theories from their own process skill and scientific attitudes. Science starts from observing, through process image which has combination pictures, text, and complete process so that student can find and build concept and facts from Biology phenomenon easily. The research by Nopitasari et al. (2013) showed that images have an effect on science skill process because images can improve student's independence in Biology learning process. This increasing learning independence can not be separated from a basic skill which is owned by student. So that student's independence gives an impact to science process skill.

The Importance of Process Image to Enhance Higher-Order Thinking Skills

The Biology learning process explains more and provides information about the phenomenon and Biology concepts are taught verbally, has a tendency to explain topics, provide sample questions, and provide practice. Education plays an important role in preparing human resources for the development of a nation. Improving the quality of education starts from the quality of learning. Good learning can improve students' high learning abilities. High-level thinking ability is a student's thinking skill to developing a research, problem-solving, and exploring the information obtained. This high-level thinking ability is closely related to creative thinking and critical thinking. Higher Order Thinking Skills (HOTS) include about critical thinking, reflective, metacognitive

and creativity. Roets & Maritz (2016) stated that thinking critically is very much needed in the context of education and the professional work.

This high-level thinking ability is very suitable for high school students because the students' thinking ability has entered the Formal Operational Phase (12 years and above) who can think abstract, logic (inductive and deductive), understand theoretical concepts and hypothesis, and change in solving problems from trial and error become systematical.

Learning thinking skills is important at all levels of education, but it is very important for middle-class students (Einsenman, 2016).

Teaching in thinking skills is the right enrichment for all students. National report on educational reforms that thinking skills play an important role, especially at the secondary level (Crump et al., 2016).

High-level thinking ability in students can improve creativity, critical thinking and can improve skills in problem-solving. This critical and creative thinking requires high-level reasoning which is high logical thinking. High logical thinking is needed by students in the classroom learning process, especially in answering questions, because students need to use their knowledge, understanding, and skills and connect it to a new situation.

Someone needs a good measure of creativity to think critically, but reflectivity can give rise to different perspectives. This is an important requirement in HOTS development. Students can think critically when engaging in creative thinking about the information they get (Roets & Maritz, 2016).

The quality of good students can be seen from the learning media used by teachers. The right media used is visual media. Learning by using process image media can improve students' high-order thinking skills. The images displayed in the lesson must be representative and communicative as a means of visualizing what they want to explain in the material and are an aid to learning scientific concepts because they are easier to understand than the textual language.

Images also contribute to the development of concepts, social values, transmission of natural images, science, and scientific activities; Building on authoritative knowledge and scientific discourse, helping to develop and change relations subjectively (Pereira et al., 2014).

The process image is a series of object modeling drawings, events or phenomenon, which between the one images to another there is a difference in terms of circumstances, position, form, and combinations that as a whole describe a coherent stage and constitute a unity. Thus, with the process image, students can remember a concept for longer duration (Long-Term Memory). Learning using process image is a solution for students who do not like to read and overcome the weakness of the use of video in learning. Basically by using video learning more effectively, however, by using video students become less understood to the material and less developed to the information gained by critical thinking and creatively, because the video presentation is too fast and less coherent. Therefore, process image is needed to support the learning media effectively and efficiently.

The image media can support a view that can support verbal or textual explanations of a science concept. The use of Process Image media can attract students' attention to learn because it is communicative, representative, and not monotonous, because it is presented images that are processed coherently and clearly accompanied by the

appropriate description in the picture.

The process image is a view of a particular object image, so that it can visualize the condition and character of the object while influencing one's perception of the object (Stefanikova&Prokop& 2015).

The use of process images can make learning more fluid and interesting. The process image that presented in the lesson can be visualized by students with different understandings and diverse conclusions. The information that students capture varies so that the information captured by each student can be developed. The information developed from the image media presented can enhance critical and creative thinking. Critical thinking by thinking convergently (leading to one point), whereas creative thinking is a divergent thinking spread from a point is a cognitive process that involves many stages to be developed into new and relevant information. Thus, the process image can improve students' higher-order thinking by visualizing images, improving understanding, and expanding the information gained from the process images presented in the lesson.

The Importance of Process Image to Enhance Student's Retention

Learning is a process of change that occurs from not knowing to know or from being unable to be. Form of the change as the result of the learning process can be knowledge, understanding, skills, behavior, attitude, and so on. The indicators of the success learning process are student achievement which influenced by various factors like student's retention.

Retention of learning is student's ability to remember concepts and theories that have been studied previously in a certain period, which can also determine the results of learning process. Retention indicates some information that can remember and recall after a certain period and the information stored in student's long-term memory.

Retention of learning has an important role, so the process of change that occurs as a result of learning can be permanent and last a long time. Basically, the process of learning not only focuses on the mastery of concepts but also on the retention of students regarding the concepts that have been studied previously which still attached or easily forgotten.

Basically, memory consists of three components are sensory registers, short-term memory and long-term memory. Sensory register is a memory about various things or information which received or captured by the senses and only can survive within a short time. On the contrary, short-term memory is memory or information storage systems which longer than the sensory registers. Long-term memory is memory or information storage systems which can survive for long periods of time, so the information that has been stored can be expressed back (recall) at a certain time. This was due to long-term memory can store information more complete and reinforced by repetitions.

Some psychologists argue that human memory will be increased when the person is processing the information in meaningful activities (Otgaar et al., 2010).

Every student has ability to remember or recall which is different from one and other. Recently, the low retention rate of the student is still a common problem which influences the student's achievement.

Some of the factors that influence the rate of student learning retention are the background of students, student disposition variables (which can be changed at any time), student's behavior, social and environmental elements of education as well as

external factors (Bogaard, 2012).

The differences of student's retention are influenced by many factors which divided into internal and external factors. In addition, there are also other factors like original learning, over learning and repetitions. Basically, the students' retention rate was influenced by a time interval of receipt and retrieval the information, but rather is determined by the variety of activities during the time interval.

Student's retention classified as a complex system and required efforts and specific strategies to increase it (Forsman J. Bogaard, M. V.C.Linder, D. Fraser, 2015, Forsman, J., C. Linder, R. Moll, D. Fraser, and S. Andersson, 2014). Educators can organize and customize learning process at school to encourage the improvement of student retention (McGregor & Mills, 2012).

The low level of student's retention can be improved with appropriate methods gradually. Educators have an important role in such efforts. One of them is the use of media on learning process which can facilitate students to remember information related to the theories and concepts for a long time. Thus, students' understanding of the theories and concepts can be attached for a long time.

As we all know, retention related to the ability to remember that does not regardless of the observed activity. As for the observed activity in learning is close to the process image that can visualize the concept or theory gradually.

Media based on process image can facilitate students to understand concepts and theories regarding a certain material through the arrangement of images (picture) accompanied by captions that overall describe a stage which is coherent and intact. Thus, students can understand and be able to remember information related to the concept for a long time than only through a description of words (verbal explanation). It can also be used as one of the solution to overcome the student's interest in reading which relatively low and can also overcome the weaknesses of the use of video in learning. Basically, the video belongs to the multimedia that can attract students, but it's less effective for early stages of learning that focuses on the basic concept.

Learning device that usually has been used requires optimization or update in order to improve the attention and interest of student (Kloser, 2013). Gilmartin in 1982, which studied the effect of the use of maps in learning, Mayer and Anderson in 1991 argued that the combination of visual media and verbal information or textual information can improve the understanding of science concepts and theories. In addition, Wu and Shah in 2004 argue that the visual media are able to provide a variety of representation and overview of a concept that allows students to connect between the various representations of these and other concepts that are relevant. Therefore, it can be concluded that visualization has important role in science learning process (Vavra et al., 2011).

Some researchers argue that visualization including image or picture can support verbal explanations or textual information about a concept of science. The use of media based process image can attract the attention of students to learn because it is informative and communicative. As we know, the attention of students in learning influences the student's retention and also their achievements.

The use of media based on process image can also facilitate the students to map information from the various concepts and theories about a material so that it can be stored systematically in the brain. Based on the constructivist theory, learning is activities that allow students to construct their own knowledge so it will be

meaningful and can remember for a long time. Thus, media based on process image can be used as one of the efforts to enhance student's retention.

The Importance of Process Image to Enhance Learning Achievement

Learning achievement is statements of what students are expected to know, understand and or capable (Veselinovska, 2011; Alkharusi, 2010). Learning achievement is a clear statement of what is expected of students at the end of the lesson and how students are expected to demonstrate achievement of the learning. Sample results question is to develop criteria for evaluation of resources; determine the accuracy, relevance and completeness of resources; identification information that is inaccurate and misleading; assess the quality of the process and products of personal information seeking; create strategies to revise the results of the information, correct and update the knowledge that has been acquired (Tuncay&Uzunboylu, 2010; Kennedy, 2007).

Learning achievement can specify the behavior in one of three domains: cognitive, affective or psychomotor (Gudeva et al., 2012). Cognitive, involves thinking, i.e. understand, analyze, evaluate. Affective, it involves attitudes, feelings and values, i.e. appreciate, accept. Psychomotor, involving physical skills, i.e. do, assemble, and disassemble.

a) The cognitive domain

Benjamin Bloom developed a classification level cognitive thinking. The system, known as Bloom's Taxonomy (Anderson and Krathwol, 2001), classify the behavior of thinking during the learning process. Taxonomy is built on the simple knowledge of the facts on the lowest level to the evaluation at the highest level. Levels according to Bloom's taxonomy of cognitive domain are as follows.

Knowledge: You know something. Comprehension: You know what you know.

Application: You can take something out of context and used in other contexts. Analysis: You can solve a problem.

Synthesis: You can create something new as a result of the analysis.

Evaluation: You can judge anything.

b) The affective domain

Affective domain deals with the emotional component of learning and ranges from basic willingness to receive information to the integration of beliefs, values, ideas and attitudes (Kennedy, 2007). Here are a few examples of learning outcomes in the affective: demonstrate professional commitment to ethical practice; resolve issues of conflicting between personal beliefs and ethical considerations; between students relates both among one to another.

c) The psychomotor domain

Psychomotor domain mainly emphasizes physical skills involving coordination of brain and muscle activity. Psychomotor domain is typically used in areas like laboratory science subjects, health sciences, art, music, engineering, drama, physical education and sports science (Harrow, 1972).

According to Slameto (2010: 54-72), there are two dominant factors affecting learning achievement, that is a internal factor that is a factor of the student, including physical factors, psychological factors, fatigue. In addition, external factors that factor outside the student which include family, school, and community factors.

Learning media is one external factor in the students' learning achievement (Sudjana, 2010). Referring to the drawing process as a learning media skills improve the students, the learning achievement realized as expected. Process skills of students involving intellectual skills, manual, social and used to build an understanding of a concept or knowledge and improving understanding has been formed (Moedjiono, 2002: 14), so that students who have these skills were able to find a concept, principle or theory just as the development of existing concepts or to perform denial of the invention (Bull and Lynn, 2005). So, if the concept well established in the student, then the student learning achievement realized as expected. So, in this case the process image as a learning medium to improve the skills of the students will realize the expected learning achievement.

In addition to the skills of the students, in the process image as a learning medium can also increase HOTS expressed previously, so expect the realization of student learning achievement better. A study conducted by Plass et al. (1998) on learning preferences and verbalizer visualizer, a combination of images and text produce better learning achievement than only text. Newman & Wehlage (1993) states that the students can distinguish HOTS or ideas in a clear, well argued, were able to solve the problem, is able to construct an explanation, able to hypothesize and understand complex things become clearer. Thomas & Thorne (2009) state that the learning achievement HOTS namely the use of higher order thinking produce better learning achievement than rote learning. Therefore, through this statement, it can be said that the process pictures, should increase HOTS students thus realizing the expected student learning achievement. Referring to the drawing process in improving student learning retention, it also can realize the expected learning achievement. It can be launched from the notion of retention or commonly known as a memory by McGregor and Mills (2012) is a person's ability to recall concepts and theories that have been studied previously in a certain period of time so that it can menentukan results obtained in the learning process. Retention also show some of the information is still able to remember and expressed again by someone for example students after a certain time interval. Thus, the information is stored in long-term memory of students. If the information is included in the long-term memory, the ability to process thought to increase better, to realize the expected learning achievement.

CONCLUSION

Process image has an important role in the learning process such as increasing science process skill, high order thinking skill (HOTS), and retention. The improvement of these three aspects (science process skill, high order thinking skill (HOTS), and retention) automatically improve student learning achievement..

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