

SE-027

SCIENTIFIC CREATIVITY IN LEARNING BIOLOGY IN SENIOR HIGH SCHOOL TEBING TINGGI CITY, NORTH SUMATRA

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ABSTRACT

This study was an analysis of the needs of scientific creativity in learning biology. The goal was to identify the extent to which teachers in the field know scientific creativity and the application of creativity itself in biology teaching and learning activities in the classroom. The 21st century demands the education to provide the human resources that are not only superior in ability to think but provide superior skilled human resources in each implementation activities of life. Scientific creativity is the skill that should be fostered to students as future generations. Needs analysis required to review the teachers in the introduction to scientific creativity, implementation, evaluation forms that have been done and how important scientific creativity in learning biology. The study was conducted on biology teachers of Senior High School Tebing Tinggi city, North Sumatra. The method used was survey with questionnaires and interviews with 17 teachers who teach in classes 10, 11 and 12. The results showed generally the teachers were already trying to do the learning that encouraged scientific creativity of students and measurement, since scientific creativity is an necessary skill in learning biology. However, after it was traced through interviews, these teachers claimed to still have difficulty in formulating appropriate learning process and evaluation of scientific creativity itself in learning biology.

Keywords: *Scientific creativity, 21st learning, biology learning.*

INTRODUCTION

Education is currently undergoing a major challenge in generating human resources which are able to compete in the 21st century. There are four categories of skills that should be possessed according by Saavedra & Opfer (2012), such as a) ways of thinking, which consists of creativity and innovation, critical thinking, ability to solve problems, make decisions and metacognition, b) How to work, ie communication and working in teams, c) device for work, general knowledge and technology literacy information communication technology (ICT), d) living in the world: citizenship, life and career and personal and social responsibility, including cultural awareness and competence. Creativity is one of the 21st century skills that is important to students as needed in future generations who will be executing all processes of life, such as industry, economy, business, agriculture, education and so on.

Creativity has an additional role in any scientific process (Aktamis and Ergin, 2008). Every individual requires creative thinking and can use their science process skills in developing the

fundamental scientific understanding. A creative scientists who need these skills to find something useful and new solutions to the problems that exist in everyday life. Creative scientists are so sensitive about a problem. Each educated individual must not a scientist, but it is important for everyone to start their life education by applying creative thinking. Although creativity is accepted as a problem solving skills in the research literature, it also requires a creative performance, identify problems, think differently and look for solutions.

Biology is a branch of science, so learning biology can be as a vehicle to train students in developing the creativity of students, especially scientific creativity. The role of learning biology is to establish the scientific creativity that is, toward science literacy of students.

Scientific creativity by Hu and Adey (2002) defined as an intellectual trait or ability, has the potential to produce certain products are genuine and have a social or personal value, is designed with a specific purpose in mind, and use of information acquisition. This relates to the creative science experiments, findings, and creative problem solving scientific, creative and scientific activities. That definition is an extension of the meaning of creativity by Torrance (in Priyadharma, 2001) is the creative nature as the process becomes sensitive to the problems, deficiencies, bottomless knowledge, the loss of elements, unharmonization and so forth, which are difficult to identify, seek solutions such as the modification and reexamination, and finally communicating the results.

Scientific creativity is different from creativity in the arts, and Hodzigeorgiou, et.al (2012) states that participation in arts activities can inspire and motivate students, but did not make the students use their creative imagination to approach tasks and other activities, such as problem solving and ask questions. Therefore, scientific creativity requires sustained attention and focus on the idea or issue because it is the result of a deliberate cognitive function (taking place in the prefrontal cortex), although there are times when making one's spontaneous cognitive creativity to solve problems (Dietrich, 2004).

Scientific creativity is expected to grow at a student when getting the right learning process, for the teacher to be able to create a learning environment that can stimulate students' creativity in doing scientific work. Not many teachers who do not understand what the scientific creativity and differences with other such creativity in the arts for example. Teachers' knowledge about scientific creativity is important as the initial study design and evaluation of student learning outcomes. Therefore, this study is also a needs analysis to determine the extent of the biology teacher introduction to scientific creativity in preparing learning model that is able to establish or enhance students' creativity.

METHODOLOGY

The method used in this research was survey method aimed to know what extent the teachers implement learning in field which may add the scientific creativity. Data collection was carried out in October 2013 by using questionnaire with interview. The questions in questionnaire were related to scientific creativity in learning biology. Introductory study was conducted to respondents, namely the teachers of biology in senior high school Tebing Tinggi city. All respondents were teachers who teach ranging from class X until class XII either from state or private schools. The information was obtained through questionnaire with interview to 17 teachers. The data of survey results were analyzed with quantitative descriptive.

RESULTS AND DISCUSSION

Results. The questions proposed and the summary of the results of the respons of biology teachers in Senior High School Tebing Tinggi city, North Sumatera was summarized in Tabel 1.

Table 1. Respons of biology teachers in Senior High School Tebing Tinggi

No	Question	Teachers' Response
1	Do you think that scientific creativity should be implemented in teaching?	88.2% said that it's the time to train scientific creativity in learning process.
2.	Do you perform learning which may encourage the scientific creativity of the students ?	70.6% said that they have done learning to encourage the scientific creativity of the students.
3	Do you measure scientific creativity in learning process ?	70.6% said that they have measured scientific creativity in learning process
4	If any, what aspects have been ever measured and how?	16.7% said that they just measured one aspect of scientific creativity. 25% said that they have measured two aspects from scientific creativity of the students. 58.3% said that they have measured four times or more aspects in scientific creativity.
5	Do you think that the empowerment of scientific creativity should be measured in learning.	64.7% said that scientific creativity of the students should be measured in learning, whereas 35.5% said that it was not necessary.

Discussion. Based on the results of survey presented in Table 1 above, it can be stated the following points. Mostly (88.2%) of biology teachers in Senior High School Tebing Tinggi city, North Sumatera said that scientific creativity should be trained for the students through learning. Every teacher has different reason, such as scientific creativity should be trained to create the circumstance that the students are motivated in scientific thinking, to motivate the

students in producing more creative scientific writing, to create something new for the students in form of idea, opinion, or real works. In addition, mostly teachers said that scientific creativity is as one of the skills in adjusting the demand of real works. The best way to encourage the creativity, according to Brookhart (2010) is to inspire the students by giving the appropriate tasks.

Some points are very important for stimulating activities that can bring scientific creativity and according to Hadzigeorgiou, et.al (2012), the first, fostering creativity requires a strong conceptual framework. In other words, science content knowledge is a pre requisite for thinking and therefore a pre requisite for creative thinking. Second, creativity in science education is about thinking of creative thinking. Second, creativity in science education is about divergent thinking/ imaginative. Encouraging creativity in the context of school science means fun idea development in an environment that is free of criticism and non-threatening. This means that, to enable students to be creative, all ideas should be heard and not ridiculed, no matter how crazy it may sound. Third, illustration and visualization should have a central place in the science curriculum and instruction.

Fourth, the idea of "aesthetic experience" and especially the amazing ideas require special attention. Fifth, think about the future and the possibilities (ie temporal distance) as well as on past events and human (ie, spatial distance) is a strategy that can be incorporated into teaching activities. Sixth, provide opportunities for students to interact in a social environment, imaginative and divergent thinking. In short, creativity must be fostered in the social and cultural environment. This environment includes the culture of scientific inquiry and the culture of the school, and the two cultures can play a role in developing the creative thinking of students.

More than half of the biology teachers in Senior High School, Tebing Tinggi city based on the results of a questionnaire that is 70.6% claimed to have attempted to encourage the learning activities of students. However, after traced back through interviews because the answer is in stark contrast, the lesson the teacher is one direction or conventional. Learning like this is not an effective way to train creativity of students, because students play a passive role in receiving the information provided by the teacher. There are also teachers who expressed using lab-based learning to foster the creativity of their students. Teachers who claimed not done learning can enhance students' creativity reasoned that they had a problem in the preparation of teaching. Troman and Jeffrey(2011) states that creative teaching involves the ownership of knowledge. Teachers here, not just convey information to students, but acts as a messenger who then tested by existing instruments. The teachers' knowledge concentrated to produce students who can apply their knowledge in everyday life. Therefore, creative teachers have control of their own pedagogy. They choose what methods and combinations of methods, for what, and when

the learning is done. Creative teachers are also able to create and provide their own opportunities for creative teaching. They know how to exploit the 'boundaries' implementation of government education policy and practice. They are so experts in taking a chance on something unexpected to improve learning.

In line with the above results, Hadzigeorgiou et al. (2012) also stated that as a science educator and teacher of science (such as biology), the best you can do is provide an environment that increases the likelihood of emergence of creativity. Some activities may be considered more appropriate to develop scientific creativity in science education. They are more likely activities, 1) to provide an opportunity for imaginative/divergent thinking, and 2) to produce an aesthetic experience.

The answer to the statement of teachers for the third point, namely regarding the measurement of scientific creativity of students, 70.6% of teachers stated already done so, like the previous point of this answer was not significant when performed follow-up questions. Most teachers 16.7% only measure up to four aspects of scientific creativity, the rest only measure 1-2 aspect alone. Researchers use aspects of scientific creativity and according to Pekmez, et al. (2009) is the conclusion of the understanding of scientific creativity by Hu and Adey (2002). Aspects or indicators used in this survey, is 1) Be sensitive to the problem, 2) the ability to produce new ideas which can be accepted with technology, 3) The ability to ask, 4) Understand the world around, 5) Ability to problem solving, 6) Seeing solution, 7) Designing experiments, 8) Scientific imagination, 9) Identify difficulties, 10) Make predictions or hypotheses. Teachers who answered yet take measurements reasoned that scientific creativity in the current study is only necessary attitudes and cognitive abilities, and they ignore the skills assessment for students.

A total of 64.7% of teachers who claim that scientific creativity needs to be measured, they reasoned if the measure scientific creativity of students, teachers can know the student's ability to think and work scientifically. However, not a few teachers that states do not need to measure scientific creativity of students in biology. No need for the measurement of scientific creativity by some teachers argue that not all students have the ability and courage to show its creativity. In ability and courage of students could be because students are not familiar with the learning that can motivate them to be creative. Brookhart (2010) states that in assessing creative thinking, assessment must do several things: 1) Require that students generate some ideas that exist in some new ways. Juxtaposing two different fields or text content is one way to do so, 2) Allow students to choose (which itself can be a 'creation of ideas' on matters related to the learning targets will be judged, not on the touch aspect of such assessment form, 3) evaluation of student work against the criteria of students who are trying to achieve, if necessary, to include assessment criteria for the real work in the discipline.

CONCLUSION

Based on the research that has been done, we can conclude a few things as follows: Most of the teachers have known scientific creativity and states that scientific creativity is important to be trained in biology lessons that are part of the science; these teachers also stated that there had been doing to encourage learning and measure scientific creativity in learning. However, unfortunately after the interview did not get the same answer. It is seen from the conventional learning, such as lectures, even if there is discussion, it only discussed about the material listed in the book learning. Some aspects/indicators (4 or more) of scientific creativity in students has been assessed by the teacher, and most teachers realize that scientific creativity in students need to be measured. Constraints experienced teachers with regard to the measurement of learning and scientific creativity is a lack of scientific information related to creativity itself that is hindering the preparation of teaching. The need for dissemination of accurate information regarding the scientific creativity so that teachers can prepare lessons such as the use of a good learning model to improve students' scientific creativity.

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