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Submission date: 06-Nov-2018 12:36PM (UTC+0800)
Submission ID: 1033772434
File name: proceeding_ICMSE_LOmbok_2015.pdf (679.63K)
Word count: 3537
Character count: 21406

OBE-04
Biology Science Based PISA Framework Implications for Enhancement Students Scientific Literacy

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Abstract-PISA is an international level assessment program that aims to examine the ability of students aged 15 in reading literacy, mathematics and science is held every three years. PISA results in 2009 and 2013 showed that student achievement in science literacy is still in lower level. The poor performance can not be separated from the learning process in schools. The aim of this study was to determine the effect of science-biology based PISA frame work to increase student's scientific literacy at 3 schools in Palembang city. This research has been conducted to the eighth graders by using teaching materials of Biology science based PISA frame work. Data was collected through pre-test, post test and observation. Results showed that the teaching material Biology science based PISA framework increased scientific literacy of eighth graders of junior high school.

Keywords: PISA, Biology, scientific literacy

1. Introduction

Scientific Literacy is one of the aspects discussed in the objectives of science education in schools. In the PISA (OECD, 2012) Scientific literacy is defined as the knowledge and use to identify questions, acquire new knowledge, explain scientific phenomena and draw conclusions based on evidence. Scientific literacy is not only limited to the understanding of science but demands the ability to use the process of scientific inquiry, such as identifying the data needed to identify the problems that can be solved through scientific inquiry, to answer scientific questions and so on. In 1990, the UNESCO World Conference on Education for All argues that science education should trigger a "community of global citizens who scientific and technology", because scientific thinking is the demands of the citizens, not just scientists. So this will encourage many countries to give priority to the dimensions of scientific literacy in developing and changing science in the science curriculum (Erdogan, 2012).Furthermore, based on the draft of PISA 2015, science education that support the ability of science literacy must be composed of context aspects, knowledge, competencies, and attitudes (OECD, 2013).

Draft PISA 2015 (OECD, 2013) defines scientific literacy containing four related aspects, namely.

1. Aspects of context; include the issue of personal, local / national, and global, both in contemporary and ancient. Issues of personal situations involving individuals and families, the issue of local / national linked to the community (social), and global issues related to the cross-country life.
2. Aspects of knowledge; an understanding of the facts, concepts and theories that form the explanation of scientific knowledge. This knowledge includes knowledge of the natural world and technology artifacts (content knowledge), knowledge of how ideas are generated (procedural knowledge) and understanding of the underlying rationale and justification for their use of this procedure (epistemic knowledge).
3. Aspects of competence; include the ability to explain the phenomenon scientifically, evaluate and design a scientific investigation, as well as interpret the data and scientific facts. Cognitive processes involved include inductive reasoning / deductive, critical thinking and integrated, changing representation, constructing the exposure based on data, thinking using models, and using mathematic.

Kinds of performance expected for a display of the three competencies required for scientific literacy. The set of scientific competencies are:

a. Explain phenomena scientifically

Recognise, offer and evaluate explanations for a range of natural and technological phenomena demonstrating the ability to:

- Recall and apply appropriate scientific knowledge;
- Identify, use and generate explanatory models and representations;
- Make and justify appropriate predictions;
- Offer explanatory hypotheses;
- Explain the potential implications of scientific knowledge for society.

b. Evaluate and design scientific enquiry

Describe and appraise scientific investigations and propose ways of addressing questions scientifically demonstrating the ability to:

- Identify the question explored in a given scientific study;
- Distinguish questions that are possible to investigate scientifically;
- Propose a way of exploring a given question scientifically;
- Evaluate ways of exploring a given question scientifically;
- Describe and evaluate a range of ways that scientists use to ensure the reliability of data and the objectivity and generalisability of explanations.

c. Analyse and evaluate scientific data

Claim and argue in a variety of representations and draw appropriate conclusions demonstrating the ability to:

- Transform data from one representation to another;
- Analyse and interpret data and draw appropriate conclusions;
- Identify the assumptions, evidence and reasoning in science-related texts;
- Distinguish between arguments which are based on scientific evidence and theory and those based on other considerations;
- Evaluate scientific arguments and evidence from different sources (e.g. newspaper, internet, journals).

Aspects of attitude towards science is identified with a sense of interest in science and technology, scientific approach to assess a proper inquiry, and perceptions and awareness of environmental issues. Attitudes toward science play an important role in science studentsdecision to develop their knowledge further, pursue careers in science, and use concepts and scientific methods in their lives. The ability of a person of science contains certain attitudes such as trust, motivated, self-understanding, and values.

PISA (*Program for International Student Assessment*) is an international study on the assessment of learners15 years old developed by the Organisation for Economic Co-operation and Development (OECD). PISA assessment is intended to assess the ability of students to use the skills and abilities they have learned at school to live daily life in the full of challenges global era (Stacey, 2011). Based on the results of the OECD survey (2007), Indonesia was ranked 50 of the 57 countries that follow the average value of 393 on science literacy aspect in PISA 2006. This is due to, among others, the ability of Indonesian students in solving problems which demands the ability to examine, give reason and communicate effectively, and solve and interpret problems in a variety of situations are still lack (Kamaliyah, et al., 2013).The role of science teachers to improve science literacy ability is preferred.The role needs to be supported by a PISA framework learning-oriented material. Such materials include textbooks and LKPD and assessment. The quality of learning materials will determine the quality of science teaching. Materials which are already on the books neithercontain entirely contextual reference nor balance the theme of scientific literacy.

According Chiappe (1993), science text book should contain balanced theme of scientific literacy, namely (a) science as a body of knowledge (b) the investigation of the nature of science, (c) science as a way of thinking and (d) the interaction between science, technology, and society. Science education is an education in the field of study with the universe and all the processes that occur in it as an object lesson. In Junior high school, science study is integration between basic disciplines namely physics, chemistry, and biology. Biology is a lesson included in a clump of

natural science. Therefore, the development of biology-science learning tools based on PISA frame work is needed.

Previous research has resulted in materials science learning-oriented Biology PISA science framework that includes modules, student worksheet and valid assessment and practical. The study is limited to the development stage of producing a valid and practical without potential effect of a material oriented PISA. Based on these reasons,the problems research is how the implications of learning materials based PISA framework increase junior high school science literaciesof VIII grade. The purpose of this study was to obtain information about upgrading science literacy and achievement levels of students in PISAframe work of science-biology-oriented problems solving.

2. Method

This research has been carried out in schools under the Ministry of Education and Culture and the Ministry of Religion in Palembang. The selected schools are secondary schools with a high level (Aaccredited), medium (Baccredited), accredited lower school (C accredited). It can not be implemented due to several constraints.

This study is a One Shot Case Study (Cohen, 2007). In the One-Shot Case Study (Case Study One Shot) explained that there is a given treatment group (treatment) and subsequently observed results. In this study, students will be given biology-science teaching materials and subsequent PISA framework with observed potential effects. In short, the design of this study is described as follows

E	X	O

Description:
E = Experiment Class
X = learning using teaching materials PISA framework
O= measurement of the potential effects.

Scientific literacy competences of students areevaluated by calculating the normalized gain (N-gain). Normalized gain score is also used as a basis for determining the effectiveness of learning programs. The equation used to calculate the N-gain is:

$$g = \frac{Spost - SPre}{Smaks - Spre}$$

Furthermore, to view the research from many perspectives, variety of data collection methods and sources are used. Informal conversational interviews to get teachers respon, field notes were recorded during and after classes, and semi-structured interviews were conducted with ten students volunteers at the end of class.

3. Results and Discussion.

Pretest and posttest scores at SMP A showed improvement(figure 1). Increased quite common is the phenomenon scientifically explain competencies. Followed scores of evaluate and design scientific inquiry, and evaluate competencies and analyze the data sciencetific competencies. The higher score is the explain phenomena scientifically, its competencies easier than the other competencies. From the results of the N-gains reaching a value of 0.4 on explain phenomena scientifically competencies, 0,3 on evaluate and design scientific enquiry competencies, and the lower is analyze and evaluate scientific data competencies.it means that scientific literacy competence of students are increasing.

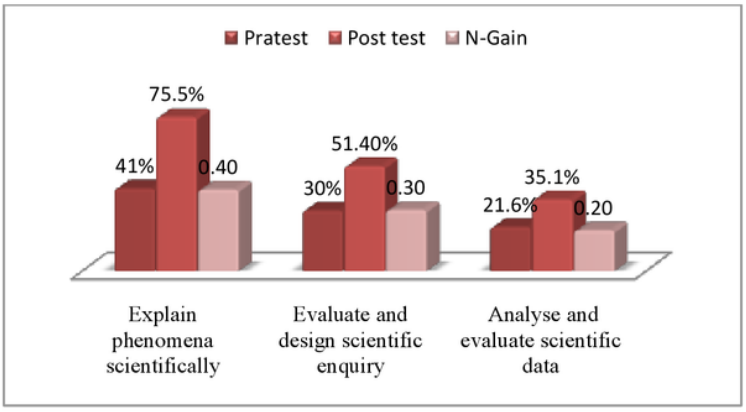

Figure 1.Mean scores of student achievement for three competencies (SMP A)

Figure 2.showed an increasing in pretest and posttest results, as well as the JuniorHigh School A (SMP A) biggest increasing is on the explain the phenomenon scientifically competence. The students can answer the quesation related to that competence such asrecall and apply appropriate scientific knowledge; Identify, use and generate explanatory models and representations; make and justify appropriate predictions; offer explanatory hypotheses; explain the potential implications of scientific knowledge for society. The increasing followed evaluate and design scientific inquiry and evaluate competencies scoresand analyze the data sciencetific competencies scores. It shows that the students' ability to analyze and assess the science data is more difficult than simply explain scientific phenomena. Analysis and assessment including the ability of high-level thinking. It must be trainedoftento enhance students' high thinking skill. Results of these achievements show that there is an studentsscientific literacyincreasing.

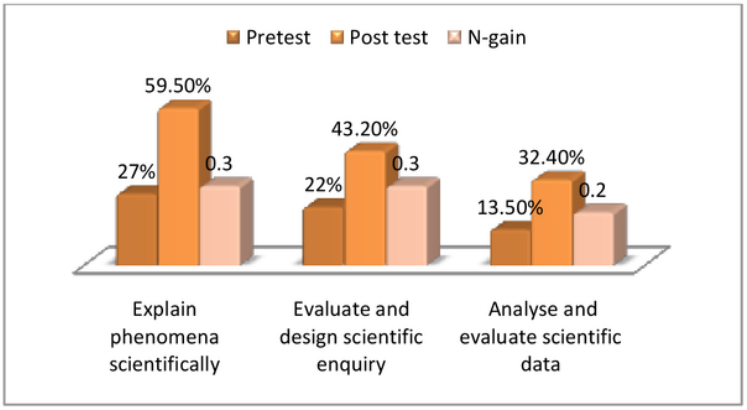

Figure 2. Mean scores of student achievement for three competencies (SMP B)

Junior High School(B)is increased but not as big as on In the Junior High School (A). The reason is on the readiness of the students receive materials based on PISA.In addition,Junior High School (A) studentsaremore active and do not hesitate to ask if there are things are poorly understood. In addition to these reasons, the students also got used to be invited to construct their own concepts learned so that students are trained to construct the concept of thinking. Based on teacher interviews, Junior High School (A) students are more active and not afraid to ask questions.There are many factors causing low PISA achievement scores but based on the results of this study it

appears that one of the reasons is because of the fact that students are not accustomed to working on the contextual problems that requires students to analysis thinking. PISA-based teaching materials is one solution to overcome these problems.

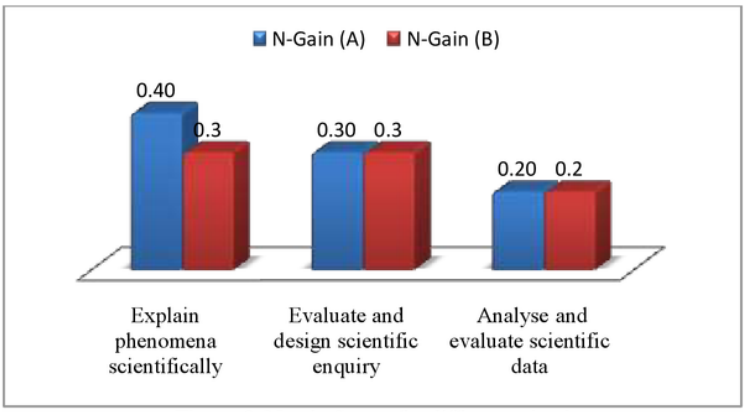

Figure 3. N-gain Scores for different school

From the results of the N-Gain, both school's competence are increased. This explainsthe phenomena that N-Gain score for scientific competencies is 0,4and the N-gain scorefor evaluate and design scientific enquiry competencies is 0.3 which is at medium range. The n-Gain scores for ability to analyze and evaluate ison low range.Some students were unable make a question about dehidration after reading the case. Most student unable to analyze and evaluate the graph about diseases of the excretory system that causes death.

According to the interviews data, one of its reasons is because students are not accustomed or trained to analyze and evaluate the scientific data. This competenciesareincludedin high-level thinking abilitybased on Bloom's taxonomy. Based on N-Gain, we can see that the PISA-based teaching materials can enhance students' ability to higherthinking, thus increasing students' science literacy skills. Besides of based on the results of interviews with teachers, teaching materials based on PISA encourage teachers to be more confident in teaching and inspire teachers to make and use the PISA teaching materials based on different materials.

Each high performing country explains its success in internationalassessments in a different way: Singapore refers to excellent structure of school andcurriculum. Japan highlights constructed lessons and the culture of lessonstudy. Finland points to teacher quality. Hong Kong-China points to a combination ofstrong procedural work, depth in the treatment of mathematics and the Confucianheritage. Netherlands (one of the best European performers) often cites its textbooks (Stacey, 2012).We can all learn something from all of these, that success can be achieved in many different ways, and thatthe path to improvement will be different in different countries.Based on this study, we can increase the PISA scores using PISA framework basedteaching material and teaching quality.

4. Conclusion

Based on the results of research and discussion described previously, it can be concluded that the use of excretory system teaching materials based onPISA framework can improve student's scientific literacy. The nurturanteffect of PISA-based teaching material are increasing confidence in teaching, increasing students activites so as to enhance the learning process in the classroom.PISA frame work basedteaching material gives students the chance to practice, enrich their empirical experience, and train their thinking skill.

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