



IMPROVEMENT OF STUDENTS' SCIENTIFIC WRITING OF BIOLOGY EDUCATION OF SEBELAS MARET UNIVERSITY THROUGH READING PROJECT BASED LEARNING

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ABSTRACT

This study examined how students' scientific writing skills changed over as they participated in the Reading Project Based Learning (RPjBL) model. This action research was conducted by Biology Teacher of Education Program Faculty of Teacher Training and Education in SebelasMaret University. The results show that the scientificwriting level increased on the last writing activities. It was suggested that RPjBL could have a positive impact on students' scientific writing. Students who experienced the RPjBL emphasized the sentences reflecting the application and used high cognitive level sentences.

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Keywords: reading; project based learning; scientific writing

INTRODUCTION

Science and technology developments bring great impact on various aspects of life, including education. Education is a very crucial because the quality of human resources and high can only be shaped and maintained through good education system. This reasoning implies to the demand that the education system needs to be updated continuously in accordance with the development of other aspects in life in order to create intelligent, creative, innovative, and possessing appropriate character according to the world needs.

Mastery of science, both *hard science* and *soft science* is indispensable in narrowing the gap between Indonesia and the developed countries, particularly in the fields of economics and technology. Students' achievement in learning science is actually determined since the first time they are introduced to science and how they asso-

ciate science with their daily life. Teacher plays an important role as the transformer agents and precursors so that students can gain meaningful learning. It is still considered difficult for most teachers to fulfill the demands of scientific approach, including inquiry training in every process. However, it turns out that learning science cannot be separated from the social processes that occur in it because no matter how good the students create inquiry, it would be useless when they cannot communicate it using appropriate scientific language understood by others. This goes in harmony with the opinion of Osborne (2010) which states that there is a shift of student centered inquiry-based into focusing in the role of language and communication in classroom practice.

PISA 2012 data shows that Indonesia still ranks low in scientific literacy and reading. The low science literacy is allegedly associated with students' low interest in literary reading. Various studies have shown that students will find meaningful learning if he/she is actively involved in the learning process so that he/she could interpret, think and conduct science as practiced by

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scientist. Deane(2011) states that the assessment of literacy skills mainly includes the ability to read and write with regard to the process of thinking, and the implications of cognitive assessment for writing assignment; particularly the ability to read, write and think; grows considerably when students construct scientific arguments that support the concept in which he considers as true.

New demands of literacy are particularly related with the development in the digital era, where the number of online books or journals amount more than offline or print version. In this case the teacher must train the students to do inquiry learning, started with reading habit and searching for relevant literature with the subjects. Next, the teacher must also train students to find the main idea implied in the literature, and connect those new ideas with the previous knowledge through assimilation, accommodation and equilibration. Teacher focus is no longer on how he teaches, but onto how well students can learn.

The observation result on plant anatomical learning in biology education program shows that the willingness and ability of the students in writing scientific papers are still very low, as evidenced by significant amount of plagiarism when they constructed papers and lab reports to be presented. Practical reports and papers are almost identical in each year shows that the student is still incapable or inconfident in pouring their scientific ideas even though they had engaged directly in scientific activities in many ways. This fact deserves serious attention, since the publication of Regulation of the Director General of Higher Education 152 / E / T / 2012 on Scientific Publications; that the students are required to create and publish scientific literature as one requirement of graduation.

Some students stated that they generally get difficulty in writing scientific papers because they do not really know the rules of writing good scientific papers. This is worsened by the lack of reading of recent scientific papers. Many students rely solely on lecturers as the main source of learning, or simply refer to the textbook used in the course. It is not a surprising phenomenon to find that students are only capable to write according to what they believe. Writing a short response to the laboratory activities, reflective journal or summarizing article can not necessarily improve their scientific writing skills, though all of aforementioned literatures are able to help creating a better understanding. Scientific reading and writing is closely linked because someone could write a good, accurate and systematic scientific paper only if he has gained a lot of knowledge through

practical and theoretical experience through reading scientific papers written by others.

Reading is essentially a cultivated/habituated activity, but the core of reading is not merely assembling of a couple words, sentences or paragraphs, but the reader needs to extract the essence or the main ideas implied in the literature. Reference journals have clearly mentioned that cognitive ability can be built and developed through reading using appropriate strategies. The next stage that must be achieved by the students is writing, especially after finding cognitive conflict of texts (if any), students are expected to develop appropriate and tested arguments. This is supported by research conducted by Kendeou et.al (2014) that reading comprehension depends on the integration of various cognitive processes. When understanding a sentence, one must process the visual words, identify and understand its phonological, orthographic and semantic meaning. In understanding the meaning of a passage, one must process and connect ideas, and produce a coherent mental representation from the related text. Wrong knowledge or misconceptions will result in incorrect reading comprehension.

In practice, reading is often considered to be a receptive skill, writing skill as expressive and thinking as reflective skill, but such assumption are often misleading. Reading actually is not just weaving words or sentences, but it also requires writing record, reflective questioning or discussion with others. All these activities are basically indirect part of the reading, but it is surely useful to support reading comprehension (Schneider, 2014).

Learning science which can accommodate the formation of reading literacy cannot happen suddenly, it must be planned systematically by using appropriate models, strategies or learning approach. One of learning model that can be used to integrate reading appropriately is Project-Based Learning (PjBL). PjBL motivates students to seek a solution in anyway they like and are considered as the closest to what they want. Prior knowledge or previous experience owned by the students will be explored further through a given task as to allow the achievement of new knowledge or improvement of old knowledge. In other words, this model gives students freedom in deciding what should be studied further and how they want to learn.

Krauss and Boss (2013) stated that inside the application of the PjBL, students will obtain essential knowledge, skills and correct judgment through the investigation of a wide range of open-ended questions so that they really conceive

of what they have obtain from their own learning process. In other words, PjBL can fulfill all the necessary scientific approach needed in science learning. The aforementioned reasonis what makes the PjBL is as one of the recommended learning model in Curriculum 2013.

In college, the project is an ideal tool in stimulating students to demonstrate their knowledge more widely, for example the ability to do higher order of thinking or fully comprehending the materials. Through the project, both lecturer and students are working together to connect the subject matter, learning objectives, key concepts and knowledge acquired individually or collaboratively (Roessingh and Chambers, 2011).

In this study, PjBL is integrated with reading. This reading activity is carefully planned so that it becomes the main prerequisite factor before the real application of PjBLis conducted. Scientific literatureas the learning source is the result of research articles published in reliable journals. Students must write scientific paper after they read a journal of their choice and supported with relevant referencesfrom at least 5 other journals and construct a logical argument..

This research was conducted with the aim of knowing whether the Reading Project-Based Learning can improve the ability of scientific writing of students in Biology Educationof FKIP UNS.

METHOD

This research was conducted in the form of Action Research on 3rd semester students ofBiology Education program of FKIP UNS in their the plant's anatomy course. The learning process is conducted in 3 cycles applying Reading Project-Based Learning. The project is given in the form of a paper on the morpho-anatomical adaptations of plants in various nature conditions.The assesment of scientific writing refers to Rhetorical ScoringGuide focused on Argument-Building Strategies (Deane, 2011), which including exemplary category (extraordinary), Cleary competent (good), developing high (well developed) , developing low (less developed), and minimum. Targeted research is at least 50% of students achieving developing high category with no minimal category students.

RESULT AND DISCUSSION

The data of scientific writing ability are obtained through paper projects related to morpho-anatomy of plants in various environmental

conditions as part of the adaptation. The paper will be categorized as exemplary (score 5) when it provides a broad and in-depth analysis that includes arguments, assumptions and implications, the use of claims and evidence to construct arguments, and builds a systematic exposition. Clearly competent (score 4) characterized by the presence of a clear argument structure, using the claim and supporting evidence, consider or accommodate the opposite argument, create a logical claim through reasoned explanations and examples with accurate evidence. Developing high (score 3) is characterized by a clear claim, although sometimes substantially less powerful, use of evidence is still limited, in response to the problem was simple, the argument is sometimes still lacking sharpness.Developing low (score 2) contains a weak argument, confusing claims, evidence is not clear, and do not refer to the many relevant literatures. The lowest category is minimum (score 1), characterized by the absence of argument, no claims, no evidence and examples, and there is no logic in response to the issues raised.

Achievement of scientific value in the course of writing Plant Anatomy is presented in Figure 1. Figure 1 shows that initially the students are still having difficulties in making scientific writing, evidenced by students who receive minimum category in cycle 1 and 2. The results of interviews with students showed that the greatest difficulty in making the paper is how to take the key information in the literature. In addition, many students use non-reputable journals in order to avoid English journals. This situation is worsened by the fact that their English skills are quite weak, so they have trouble when they are obligedto use internationally accredited scientific journals as the references. Beside that, theoretical knowledge owned by students are very limited, it appears when they discuss the general concept of plant anatomy. Most of them still refer to the textbook used on high school grade (SMA) .To overcome this problem, the lecturer tried to motivate students by giving referrals to reputed national and international journals, both in Bahasa or in English. In addition, lecturer provides the basics of how to cite the journalsas the base of arguments in the paper writing.

Getting students more familiarto read scientific journals brings an impact on the achievement of academic writing scores in cycle 3, where there are no students in the category of minimum, although there are some who still have a low developing category. By getting used to read a lot of journals, students become accustomed to seeing writing style of making good scientific pa-

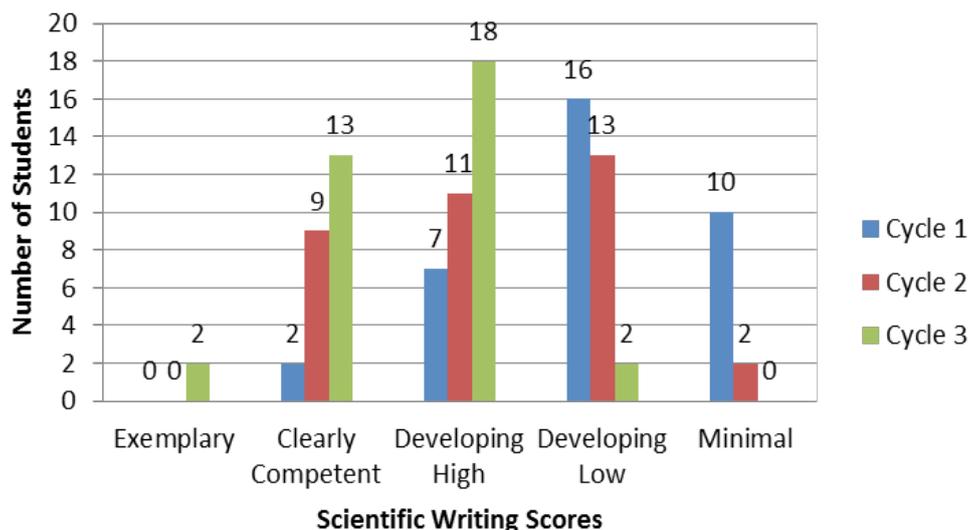


Figure 1. Scores on the Scientific Writing Assessment Separated by Aspect for Each Cycle

per so that later they can write a scientific article with good quality. The results of this study are relevant to the research conducted by Fang and Wei (2010), which proved that the inquiry-based science learning, integrated with reading brought a positive impact on high school students' scientific literacy.

Sampson et.al (2013) proved that students in science class was able to write science specifically and argumentatively and comprehended the concept of learning as they participated in a science laboratory activities applying Argument-Driven Inquiry (ADI). ADI has the characteristics of student-centered, writing-intensive based and requires high skills in reading literature.

Reading is a complex cognitive process that includes several activities such as recognizing letters and words, connecting it with the sound and meaning, and draw conclusions. Mental activity in reading includes memory and comprehending, that is why cognitive development is influential to someone's ability to read. Reading skills are not formed for granted, but it must be trained, developed and improved. Readers need to master the reading skills for the decoding process (translating symbol-letters to sounds or visual representations) and comprehension (Zhang et al, 2013). The observations proved that students who achieve exemplary category all stated that they were trying with all their might to complete the project, through comprehensive reading activities that. Some students even admit that after they used to read scientific journals, it is much easier for them to pour ideas, arguments and a new understanding in the form of scientific writing. Even they were able to construct an argu-

ment using the data and information to correct the mistakes by previous investigators. This shows that reading, studying and understanding the literature requires "experience", not just connect many words, but also requires the ability of future thinking of what have been read and studied as the basic knowledge for the next material.

To improve both the scientific writing ability and material comprehension, students should become more authentic and educative. To be more authentic, the project tasks must be more realistic, stimulate inquiry and challenge students to be more serious in scientific writing. The seriousness of scientific writing covers how to transform the data through the evidence, argue with the evidence, coordinate the theory with evidence and improve writing in case of accurate objections.

Levy and Ellis (2006) defined how the argument occurred during the writing process. The argument is essentially begins with the onset of the problem that underlies the need for research conducted or revised. In learning, not everyone has the same view of the line of thought of a problem so that they each have claim when discussing or talking about a topic. Accepted claims must contain a strong argument and refers to problem solving. Furthermore, Devick-Fry, Klages and Barnhill (2010) had observed that when teacher candidates were given reading method treatment, they could demonstrate the ability of creating written inquiry, namely QQR (Questions, Quotes, Reflections) and QTQR (Questions, Thoughts, Quotes, Reflections) better than those who did not get the same treatment.

Scientific literacy is closely related to the

habits and skills of students in understanding, using reading and reflecting in the inquiry process so that students need to be familiarized with the process of systematic inquiry through reading and writing. Different rules of writing scientific papers inevitably forces teachers to better understand that the scientific literature has not yet finished in the form of a summary or record, but at the same time it should strengthen theory or practical experience of the previous knowledge and become the foundation for further applied knowledge. It becomes important for students to create literature that describe the inquiry in accordance with the dimensions of the high-level cognitive processes. Referring to the aforementioned facts, getting students familiar to “writing to learn by learning to write” is crucial, especially since the education in Indonesia has not incorporated reading and writing scientific activities explicitly in the curriculum.

CONCLUSION

The research result proves that the application of Reading Project-Based Learning can improve the ability of students in scientific writing in Biology Education Program FKIP UNS.

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