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Research Article

Comparison of Scientific Literacy Competence Domain Appearance in Task Questions of Biology Electronic School Books (BSE) at Each Grade of High School.

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Abstract.

This descriptive study aims to determine the comparison of scientific literacy competence domain appearance in task questions of biology electronic school books (BSE) at each grade of high school. The subjects of this study consisted of 1,650 questions contained in the 2009 edition of the BSE Biology book for grade X, XI, and XII which were determined by purposive sampling technique which included sample questions and question exercises. The instrument used in this study was a document analysis sheet about the domain of scientific literacy competencies. The results of the task question analysis show that the higher level of the grade, the aspect of explaining scientific phenomena and aspects of interpreting data and scientific evidence has increased compared to the aspects of evaluating and designing scientific research that tends not to appear at each grade level. Therefore, based on these results it can be concluded scientific literacy competence domain appearance in task questions of high school biology electronic school books are not distributed well, so it needs improvement in the preparation of these questions in order to increase the domain of students' scientific literacy competences.

Keywords: question domain of scientific literacy, Biology School Book (BSE)

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1. Introduction

The rapid changes in science and technology have greatly improved the quality of human life. However, these developments are often accompanied by new issues related to ethics, morals and global issues that can actually threaten human dignity and survival. To solve these various problems, people who have scientific literacy are needed [?], [?]. Scientific literacy is one of the areas of Program for International Student Assessment (PISA). PISA is a program which created by the Organization for Economic Cooperation and Development (OECD) which aims to monitor the results of the education system related to the learning achievement of 15 years old students [?].

Scientific literacy is a substantial ability that must be possessed by students. Scientific literacy is considered to have an important role in preparing students to face the challenges of rapidly changing of social life [?], [?]. Moreover, in the 21st century scientific literacy has now become a demand to be mastered by every individual, both in everyday life or in the world of work [?]. Science literacy is the ability to engage with issues or problems related to science and technology as a reflective citizen [?]. Scientific literacy is also a person's ability to understand science, communicate science, and apply scientific knowledge to solve problems so that they have a good attitude and high sensitivity to themselves and their environment in making decisions based on scientific considerations [?]. PISA in 2015 determines that there are three major dimensions of scientific literacy in its measurement, such as science competence/ process, science content/ knowledge and science context/ application. Students who have high scientific literacy abilities are expected to be able to understand the issues that occur and relate them to applying the knowledge they have in their daily life.

One of the parameters for the quality of education in a country is reflected in the achievements of its students in participating in National and International studies. Based on a survey conducted by TIMSS (Trends in International Mathematics and Science Study) which is conducted every four years, in 2007 Indonesia was ranked in 35th position out of 49 countries and in 2011 Indonesia was ranked in 40^{th} position out of 42 countries. The survey results showed that the students' average score of scientific achievement was below the average international score. In line with the survey conducted by TIMSS, a survey conducted by PISA (Program for International Student Assessment) the average score of scientific literacy achievement in Indonesia is still far below the international average. In 2003 Indonesia was in 38th position out of 40 countries, in 2006 was in 50th position out of 57 countries, in 2009 Indonesia was in the 60th position out of 65 countries, and in 2012 it was in 66th position out of 67 countries [?]. The existence of these results can be caused not only because of the learning process carried out, but because of the books used. [?] states that the understanding of science learning which leads to the formation of students' scientific literacy, seems to be still not understood well by science teachers. Furthermore, [?] states that the learning process and the evaluation tools used are still conventional and rely on conceptual mastery, so students are not familiar with this ability in school.

Electronic School Book is a type of electronic textbook designed by the Ministry of National Education (DEPDIKNAS) to be used by several schools in Indonesia. The existence of evaluation tools in this book has not been in the spotlight in research yet, especially in scientific literacy field. As quoted by [?] states that according to Cai et

al., Li et al., and Fan, the fact shows that research on book analysis focuses more on content, and only a few studies on book analysis focus on the task questions quality.

Based on the results of his research stated that BSE contains more questions that access low-level thinking skills (such as C1, C2, and C3) than high-level thinking (C4, C5, and C6) [?]. Furthermore, [?] states that many books present material by inviting students to learn actively, the presentation of concepts is very systematic, but it oftenly ends with evaluation questions that do not train students' higher-order thinking skills.

According to the Regulation of the Minister of National Education Number 46 of 2007 and Number 12 of 2008, this BSE book has been said to meet the eligibility requirements to be used in the learning process in schools. This breakthrough in book reform is one of the efforts made by the government to ensure the availability of quality, cheap and easily accessible textbooks so that Indonesian students and educators in Indonesia and abroad can obtain and use learning resources with a good quality.

The existence of a test evaluation tool that includes task questions in BSE is very important. Evaluation is an inseparable part of a learning process. [?] states that evaluation in learning process is a process for collecting, analyzing and interpreting information to determine the level of students' learning objectives achievement. As a very important part of the learning process, evaluation should be designed and implemented by teachers. The existence of an evaluation tool in source books can support students' abilities which will be measured from a learning process that has been carried out. Therefore, the researcher wanted to map the scientific literacy competence domain appearance in questions of biology electronic school books at Xth grade of high school which included the aspects of explaining scientific phenomena, evaluating and designing scientific research, and interpreting scientific data and evidence [?].

2. Method

This research uses a descriptive method. The subjects of this study consisted of 1,365 task questions contained in the 2009 edition of the biology electronic school books for grade X, XI, and XII which were determined by purposive sampling technique which included sample questions and question exercises. The instrument used in this study was a document analysis sheet about the domain of scientific literacy competence which contained numbers, codes, questions, the domain of scientific literacy, and aspects of scientific literacy competence. The data processing uses the percentage formula [?] as follows:

% the appearance =	$\sum$ the appearance of questions on the domain of scientific literacy competence in BSE
	$\sum$ all questions in BSE

After performing these calculations, then categorization is carried out based on the [?] formula as follows:

TABLE 1: Percentage Category of the appearance of questions in Cognitive Levels of Revised Bloom Taxonomy in High School biology electronic school books.

Percentage	Predicate
81-100%	Very Good
61-80%	Good
41-60%	Good Enough
21-40%	Low
< 21 %	Very Low

The next stage, based on the results of the categorization, is interpreted to provide further explanation regarding the data obtained.

3. Results and Discussion

The task questions in High School biology electronic school books were analyzed as many as 1,650 questions which included 395 sample questions and 1,365 practice questions. The questions consisted of 295 questions in grade X; 852 questions in grade XI; and 613 questions in grade XII. Question analysis is carried out on the domain of scientific literacy competences which includes describing scientific phenomena, evaluating and designing scientific research, interpreting scientific data and evidence. Based on the results of the analysis of the domain aspects of the scientific literacy competence, it is obtained the different percentage values that are obtained at each grade level. The results were presented in Table 2.

In general, based on Table 1, it can be seen that the total average appearance of BSE task questions containing the domain of scientific literacy competence is in the very low category. Every aspect of the domain of scientific literacy competence on BSE task questions for each class level has a very low percentage value.

In grade X, the task questions in BSE do not appear the domain of scientific literacy competence at all, when it is compared to grade XI and XII. The domain of scientific literacy competences includes the aspects of explaining scientific phenomena,

TABLE 2: Comparison of the appearance of scientific literacy competency domains in BSE questions for each high school grade level.

Domain Aspects of Science Literacy Competence	Percentage of Each Class (%)			Average	Category
	X	XI	XII		
Explaining scientific phenomena	0	0.47	1.63	0.7	Very Low
Evaluate and Designing scientific research	0	0	0	0	Very Low
Interpreting scientific data and evidence	0	0.35	2.61	0.97	Very Low
Total Average (%)	0	0.27	1.41	0.56	Very Low

evaluating and designing scientific research, and interpreting scientific data and evidence [?].

Over all in Table 2 shows that the aspect of interpreting data and scientific evidence is the aspect that has the highest percentage appearance value in the BSE questions, which is 0.97% compared to the aspect of explaining scientific phenomena which is only 0.7%. Aspects of evaluating and designing scientific research do not appear at all at this grade X BSE. In grade X, the three aspects of scientific literacy competence are not found at all. This indicates that at the grade X, students have not been equipped with the ability to develop scientific literacy competencies. The results of the analysis show that BSE tends to provide students with inquiry-based questions which are still lacking so that they are still dominated by conceptual abilities. [?] revealed that science learning in Indonesia generally emphasizes the level of memorization without being followed by an understanding that students can apply to real life. Learning with the memorization method is one of the causes of the low scientific competence of students. Because of the importance of learning by students by not only memorizing but also practicing the scientific literacy questions in the learning process.

In grade XI and XII, the appearance of questions that contain the domain of scientific literacy competences is also very lacking. Although there is an increase in the percentage of appearance of scientific literacy competencies in class XII when compared to class XI. However, this percentage increase does not show a good significance.

In class X and XII, the percentage values for the appearance of aspects explaining scientific phenomena were 0.47% and 1.63% with very low categories. Explaining phenomena scientifically includes competence in applying scientific knowledge in a given situation, describing phenomena, predicting changes, identifying descriptions, explanations and well predictions. In the aspect of explaining the scientific phenomenon, students are required to remember content that fits knowledge in certain situations and use it to interpret and explain interesting phenomena [?]. Such knowledge can also be used to generate tentative explanatory hypotheses in the contexts where there is a lack of knowledge or data.

In the aspect of interpreting scientific data and evidence, the appearance of BSE task questions that contained this aspect for grade X was only 0.35% and grade XII was 2.61% with a very low category. This competency trains students to analyze, interpret data, and also make a conclusion from a given case [?]. In this competency, students are asked to change one form of representation into another form of representation and make conclusions from the results obtained. For example, converting experimental data into tables and graphs, and making conclusions based on the graphs obtained. Furthermore, the [?] suggests that in aspect of interpreting scientific data and evidence, it is better if students interpret data starting by looking for patterns, build simple tables and graphical visualizations, such as pie charts, bar graphs, scatter diagrams, or Venn diagrams.

In the aspect of evaluating and designing scientific research, there was not found at all the appearance on BSE task questions that contained this aspect in all grade levels, both grade X, XI and class XII. The existence of these findings are also supported by the results of the 2012 PISA assessment that Indonesian students have not yet been able to achieve the competence to evaluate and design scientific research [?]. This competence requires students to design research procedures according to a given case. Competence in evaluating and designing scientific investigations is needed to critically evaluate reports of scientific findings and investigations. This competence also depends on the ability to distinguish scientific questions from other question forms or to recognize questions that can be investigated scientifically in a particular context. This competence requires knowledge of key features of scientific investigation, for example: what things have to be measured, what variables must be changed or controlled, or what actions must be taken in order for collecting an accurate and precise data. This requires the ability to evaluate the quality of the data, which in turn depends on recognizing that the data are not always completely accurate.

Therefore, science learning need to be carried out with scientific inquiry to develop students' thinking skills, scientific work, and scientific attitudes and communication skills as important aspects of life skills [?], [?], [?] [?]. This scientific process becomes the standard in science learning experience and it can equip students' holistic competence. In science learning, students are able to acquire three kinds of skills and understanding, such as scientific principles and concepts, reasoning skills and scientific scientist work procedures, and understand the nature of science as a particular form of human work [?]. Products of knowledge, scientific process skills, and scientific attitudes must be taught in science learning and the assessments carried out must be adjusted in order to improve scientific literacy competencies and include the aspects of low level science understanding concepts (C1, C2), application of concepts (C3), high level science understanding concepts (C4, C5, C6).

In the 2013 Curriculum, it is recommended to use authentic assessment which includes assessments that describe the overall abilities of students (knowledge, skills, attitudes (social, personal, and religious). Thus, the results of scientific literacy measurements carried out by PISA can be used as a reference in mapping students' scientific literacy skills in Indonesia.

Scientific literacy can also be provided by implementing learning models that can facilitate aspects of scientific literacy. Project-based learning (PjBL) is one of the recommended models to equip students' scientific literacy [21]. This learning model can facilitates the scientific experience and the application of the aspects of scientific literacy. In addition, teachers can also implement other scientific activity-based learning models to develop students' scientific literacy skills.

4. Conclusion

The appearance of scientific literacy task questions in the domain of science literacy competencies in the grade X, XI, and XII Biology electronic school books (BSE) shows different percentages in each aspect. The highest to lowest percentages are in the aspect of interpreting scientific data and evidence; explain scientific phenomena; and evaluating and designing scientific research. There needs to be an improvement in the equality of the appearance of these literacy competency domain questions in the high school Biology electronic school books (BSE) by involving evaluation experts in order to enrich the questions that contain the domains of scientific literacy competences so that students' scientific competences could be increased.

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