

CHAPTER I

INTRODUCTION

1.1. Background

The development of knowledge of science which in accordance with the rapid advancement of technology requires good education system to prepare peoples to be able adapt to a novel situation, absorb and filter new information, and solve various issues they face in life with science-related skills (OECD, 2007). It is in line with the core objective of science education which termed as scientific literacy (Chaisri, 2014; American Association for the Advancement of Science, 2014). Scientific literacy is defined as the incorporation of scientific idea and concepts within and across various scientific disciplines, as well as scientific practices (Shwartz *et al*, 2006). It relates to the individual competencies of using scientific knowledge, identifying questions, and drawing evidence-based conclusions (OECD, 2013; Master, 2005).

Assessment as an important part of evaluation is tightly interconnected with curriculum and instruction. It assess whether or not the goals of education are reached after several teaching and learning process (Edutopia, 2008). Many strategies can be performed to obtain information about the progress and achievement as a result of education process through the assessment, including; class-based assessment, school-based assessment, regional, national and international scale assessment, according to the objectives of the assessment (Looney, 2011).

Educational organizations have been developed the international-scale assessments which focus on the achievement and trends of education system across countries, within country. The results of this international study could reflect the quality of education in the member and participating countries, enrich and enlarge the national view in preparing and facilitating the best way about the weaknesses and strength of a country, finally able to monitoring the improvement of the country.

Program for International Student Assessment or PISA as an international large-scale comparative survey are purposes on monitor the trends of students' literacy and offers insights for education policies of participating countries (OECD, 2013). This three-year cycle assessment focuses on 15,3 – 16,2 years old ability to apply knowledge and skills to contextual life (Master, 2005; OECD, 2013). As the compulsory education in entire world is completed in age 15, it assumed those with age 15 have been mastered the basic skills and sufficient knowledge to start entering adult life (OECD, 2013). It also reflects how well the education prepares the youth to challenge, compete, and solve real-world problems they encounter in future work place with the knowledge they have (OECD, 2013; Tao, 2008).

Includes in PISA surveys started from 2000 to 2012, Indonesian achievement in PISA, especially in science always below the average score of OECD's countries (500) and took the fifth last place among all participants (Hadi & Endang, 2009 ; Burckhardt, 2014; OECD, 2003; OECD, 2004; OECD, 2006 OECD, 2013). Since the first survey of PISA in 2000, Indonesia attained 38th

place from 41 participants with average score 393 (OECD, 2003). In second survey, Indonesia obtained the 38th place from 40 participants in 2003 with mean score 395 (OECD, 2004). Furthermore, the third survey in 2006 where science became a major domain of assessment, put Indonesia in the rank 53th from 57 participants (average score 395) (OECD, 2006) and in 2009 with the average score 383 make Indonesia in the rank 62th from 65 participant countries. The last survey in 2012 put Indonesia in the rank 64th from 65 countries with mean score 382 (OECD, 2013a).

The finding was also informed that most of students' were reached the basic level of scientific literacy. The cognitive load by remembering the simple facts (like name, fact, term, simple formulation) is categorized at this stage. Moreover, the students at this level only used the common scientific knowledge and familiar situations to create or evaluate a conclusion (Rustaman, 2010).

The involvement of Indonesia in this international scale assessment was drawn interest facts about Indonesia achievement. The data which outlined the low achievement of Indonesian should be used in further analysis to investigate the possible factors lowering the 15 years old Indonesian students in PISA assessment.

There are many factors affected the successful of learning, but several study reveals that the textbooks is one of factors which determined what students have learned. The textbook are widely use as the fundamental sources of information to basic biological concepts, scientific research process, experimental activities and very often the only source of knowledge to which the students have

access (National Research Council, 1997; Haury, 2000; Teixeira *et al*, 2011). Moreover, the teachers are actively use textbooks as their main instructional tool and reference sources (Cobanoglu & Sahin, 2009) and to give assignments as well (Özay & Hasenekoğlu, 2007).

Governor regulation of Education National Standard No. 19 (chapter 42, 2005) states every educational unit must have the supporting material of learning to create the well-regulated and continuum learning. Furthermore, the regulation of Ministry of Education No. 11 (chapter 1, 2005) also notes that textbook play an important role to increase education quality in primary and secondary school (Masduki *et al*, 2013).

The data of the use of science textbooks as basis for instruction is reported by Martin *et al* (in Oates, 2014). It compared the used of science textbook in England, Singapore, and Finland. About 4 % the textbook are used in England, 68 % textbooks are used as basis for instruction in Singapore, and 94% in Finland. It also reported that the less of textbook used as instructional media might relates to the lower score attain by England compared to those countries. In addition, the Singapore and Finland always be the top performer in PISA test (Oates, 2014).

Previous study about the quality of the question embedded in students textbook reveals that evaluation in junior high school textbook of math have the applying aspect about 66% - 92%, where the reasoning aspect only 0.39% - 11.63% (Masduki *et al*, 2013). The low percentage of reasoning aspect makes the students is not accustomed to solve the challenging problem, creative, analytic and critical thinking issues.

In carrying out the survey, PISA measured students' literacy skills through a set of questions which arranged in booklets of questions. The textbook also have the subsets of question to evaluate what students learned through a learning process. Most of schoolteacher usually had the students to complete the exercise in textbook as the part of assessment after being taught. The quality of the question within biology exercises mostly posed to the students, especially in textbook were presumably be one of the factors determining students' success in achieving goals in learning biology. It also expected that the format of the question was liable in determining students' success in responses a kind of test.

The tendency to answer the question they get used to face with will help them minimize the time consumption to answering test which include those common types of questions. It was presumable that the low achievement of students in PISA survey caused by the limited familiarity of the students to the type of PISA question or there are the differences of cognitive level and format of PISA question with question mostly posed by the students, especially in textbook (Anagnostopoulou *et al*, 2012).

The compulsory of education in Indonesia was end in the late of junior high school. The essence of the matter was taught in the level of junior high school was estimated influence the result of PISA assessment. Nowadays, Indonesia is facing the changing of curriculum from KTSP curriculum to 2013 curriculum. The shift to new paradigm in 2013 curriculum pays a focus to empower and acculturate life-long learning and provide pupils with the key conceptual and procedural knowledge for promoting scientific literacy

(Kemendikbud, 2014). But the 2013 curriculum is still implemented in some pilot schools in Indonesia.

The pre-observation about the printed learning material used in teaching science in Binjai was done in November 2014. It was found that the public junior high school in Binjai used the various textbooks which released by government (DEPDIKNAS and KEMENDIKBUD) and private publisher, which utilizing the both curriculum, 2013 and KTSP curriculum for teaching science.

Since the sampling of respondents is determined based on age at 15,3 - 16,2 years old, the sample in Indonesia with that age are mostly distributed in two school level namely junior high school students at grade 9 and senior high school at grade 10. The different level of school was provided the differences in period of learning science where the senior high school was having more experience with science compared to junior high school.

Students' factor such as sex identity was also collected as the crucial information in PISA survey. The measurement of this factor could give information about the tendency of how the boys and girls were prepared to challenging and taking action in future life. Miller *et al* (2006) examined 79 high school students and found that the boys were outperformed girls in the subject of science. The finding were related to sex differences lead most people to believe that boys are good in mathematics and science related domain, where girls work best in verbal related subject (Robertson *et al*, 2003). The result was similar with Indonesia achievement in PISA survey 2006 where boys outperformed girls in the whole aspects being assessed of scientific literacy (OECD, 2009). But it was

paradoxically different with Canada which shows that the girls were score better than the boys (Huang, 2010). Another study was also performed that sex differences shows the differences in behaviors, characteristics, and abilities. It summarized that females have higher verbal ability than males, where males were excel in visual-spatial and mathematical ability (Maccoby & Jacklin, 1974). Students' sex and school level are large enough to be considered affect the achievement in learning science, so both of these factors also examined in this study.

1.2. Identification of Problem

According to the background, the identified problems are:

1. Indonesian achievement in PISA, especially in science always below the average score of OECD's countries (500) and took the fifth last place among all participants.
2. The textbook are widely use as the fundamental sources of information to basic biological concepts, scientific research process, experimental activities and very often the only source of knowledge to which the students have access.
3. The quality of the question within biology exercises mostly posed to the students, especially in textbook were presumably be one of the factors determining students' success in achieving goals in learning biology.
4. Textbooks are widely used in biology education. The studies that were conducted abroad indicate that 90% of the teachers actively use textbooks as their main instructional tool and to assign homework.

5. It was presumable that the low achievement of students in PISA survey caused by the limited familiarity of the students to the type of PISA question or there are the differences of cognitive level and format of PISA question with question mostly posed by the students, especially in textbook.
6. The more students have familiarity and exercise with the questions resemble with the PISA assessment there are a tendency to get better score.
7. The students' sex and school level was also expected influences the successful of learning science, especially Biology.

1.3. Scope of Study

Based on the background and problem identification have describe, this research is concern on:

1. The source of PISA assessment was taken from *Take the test, Sample Questions from OECDs PISA Assessment* (OECD, 2009: 193-251).
2. The analysis of question within science textbook was limited only for the question in biology exercises.
3. The analysis of biology question in science textbook follow the same matter discussed in PISA assessment.
4. The textbook analyzed in this study were limited in the grade 7 for junior high school.
5. The analysis of PISA items and biology items in science textbook use the Bloom's new taxonomy (C1-C6) cognitive level and knowledge dimension, also the type of questions.

6. Students' achievement on PISA (scientific literacy and its' competencies of identifying scientific issue, explaining phenomena scientifically, and use scientific evidence) were measured by administered the students with biology question from PISA assessment.
7. The role of students' sex to PISA achievement was analyzed by use the independent sample t-test by comparing the average score of both sample groups.
8. The role of school level to PISA achievement was analyzed by use the independent sample t-test by comparing the average score of both sample groups.
9. Sample of research were limited to most frequent science textbooks used in teaching science and student in age 15, 3 to 16,2 years old which approximately in grade 9 and 10 in public school in Binjai.

1.4. Research Question

In accordance with the issues that have been stated, then the problem can be formulated as follow:

1. How are the designs of PISA test item and biology assessment in junior high school science textbook in Binjai based on new Bloom taxonomy (C1-C6) and knowledge dimension?
2. How is the design of PISA test item and biology assessment in junior high school science textbook in Binjai based on the type of question?

3. How are the students' scientific literacy based on PISA competencies in the aspect of identifying scientific issues, explaining phenomena scientifically, and using scientific evidences in Binjai?
4. How are the students' responses to the questions being tested?
5. Do the sex differences have role to students' scientific literacy and competencies in the aspect of identifying scientific issues, explaining phenomena scientifically, and using scientific evidences in Binjai?
6. Does the school level have role to students' scientific literacy and competencies in the aspect of identifying scientific issues, explaining phenomena scientifically, and using scientific evidences in Binjai?

1.5. Research Objectives

This study is aimed to:

1. Reveals the design of PISA test item and biology assessment in junior high school science textbook in Binjai based on Bloom new taxonomy (C1-C6) and knowledge dimension.
2. Reveals the design of PISA test item and biology assessment in junior high school science textbook in Binjai based on the type of question.
3. Reveals students' scientific literacy based on PISA competencies in the aspect of identifying scientific issues, explaining phenomena scientifically, and using scientific evidences in Binjai.
4. Reveals students' responses to the questions being tested.

5. Examine the sex differences effect to students' scientific literacy and competencies in the aspect of identifying scientific issues, explaining phenomena scientifically, and using scientific evidences in Binjai.
6. Examine the school level effect to students' scientific literacy and competencies in the aspect of identifying scientific issues, explaining phenomena scientifically, and using scientific evidences in Binjai.

1.6. Research Significances

1.6.1. Theoretical Significance

1. Providing information about the cognitive maps of biology PISA assessment and biology assessment in students' science textbook.
2. Encouraging the educators and publisher to create better question which stimulates students to have higher order thinking skills and able to solve the problem in real-life situation.
3. As a reference to get information about students scientific literacy in Binjai which measured based on PISA released item and for other researchers who want to continue and develop this research.

1.6.2. Practical Significance

1. It can be used as a reference to develop a better quality of question in science textbook for Junior High School.
2. As a reference to educators to make students become familiar with the question in real life situation, solving complex problem, and initiates them to start thinking critically.