ANALYSIS OF STUDENTS' ANSWERS TOWARD SOLVING PISA LIKE TEST WITH INDONESIAN CONTEXTS IN PHYSICS EDUCATION OF FACULTY TEACHER TRAINING AND EDUCATION SRIWIJAYA UNIVERSITY

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Abstract

The aim of research is to describe students' answers toward PISA like tests with Indonesian contexts. The research involved 35 students that consisted of 11 groups. The total of Pisa like tests are five essay items.. The result of research showed that: 1) 54.54% of students's answers related to temperature and dangerous elements in volcano dust toward crop plants; 2) 36% of students' answers related to waves and frequencies to solve question: effects of earthquake that caused differences of level distroys. 3) 27% of students' answers related to kinds of gases that produced in the volcano that reacted with rain water to solve question: effects of earthquake toward acid rain; 4) 27.3% of students' answers related to lack of diversity and poluttion to solve question: effect of vegetation destroys caused of smoke; and 5) only 18.18% of students' answers related to abilities of $CaCl_2$ solution to bond smoke to solve question: function of $CaCl_2$ to reduce smoke. The research was concluded that 67.28% of test items were not answered well based on answer keys.

Key Words: Analyses of Students' Answers, PISA Test, Indonesian Context

1. Introduction

Programme for International Student Assessment (PISA) is an international study that measures the ability of 15-year-old students in reading literacy, mathematics, and science. PISA is a study that is held every three years, starting in 2000, then 2003, 2006, 2009, and the last in 2012. Implementation of PISA is sponsored by the countries who are members of the Organization for Economic Cooperation and Development (OECD), including the one that is the country of Indonesia. PISA is sponsored by OECD, an intergovernmental organization of 30 industrialized

countries based in Paris, France. PISA uses the term literacy in each subject to indicate a focus on the application of knowledge and ability. For the 2003 assessment, scientific literacy is defined as the ability to use scientific knowledge, to identify questions, and to draw conclusions based on the evidence to understand and help make decisions about the nature and the changes made to it through human activity (OECD, 2003).

Associated with this scientific literacy, educators, scientists, and policy makers agree that the development of scientific literacy of students is an important goal in science education. Scientific literacy has been defined in various ways, all of which emphasize the ability of students utilize scientific knowledge in real-world situations (AAS, 1990). Furthermore, it is stated that scientific literacy is one's own scientific knowledge and use that knowledge to identify questions, acquire new knowledge, explain scientific phenomena, and draw conclusions based on the evidence on issues relating to science (OECD, 2012).

The results of an international assessment conducted by OECD, the science competencies Indonesia always below average. In 2000 Indonesia was ranked 38th out of 41 participating countries, with a score of 393. The results obtained PISA 2003, Indonesia ranks 38th out of 40 countries with a score of 395. In 2006, Indonesia ranks 50th out of 57 countries participants with a score of 393. In 2009 Indonesia was ranked 60th out of 65 participating countries with a score of 383 (OECD, 2010). PISA results last held in 2012, Indonesia ranked 64th out of 65 participating countries with a score of 382 (OECD, 2004; OECD, 2007; OECD, 2010; OECD, 2014).

Achievement of Indonesia is still very alarming, especially in science literacy. The average score was below the average score of OECD member countries (500). From 2003 to 2015 the average score for a science tends to go down, which is very worrying is the implementation of the 2012 PISA science literacy for the state of Indonesia is at the lowest position compared to the previous year, both on the acquisition of a score and ranking among OECD member states.

Based on the analysis of the results of PISA 2009, found that of the six (6) levels of ability are formulated in the study PISA, almost all learners Indonesia was only able to master the lesson to level three (3) only, while the other countries involved in this study much reach level 4 (four), 5 (five), and 6 (six). This is a challenge that must be faced in education in Indonesia, and became one of the factors for the development of the curriculum in 2013 primarily related to the deepening and expansion of the material (Kemendikbud, 2014).

Reflecting on the results obtained in the PISA Indonesia shows science literacy students aged 15 years is still very low. Low ability of scientific literacy is influenced by many factors, among others, students, curriculum, teaching models and methods used by teachers, learning resources, teaching materials, infrastructure and learning facilities, and mastery of materials science by teachers. Learners Indonesia generally less trained in solving problems with characteristics such as PISA questions. That at least can be seen from the examples of learning outcomes assessment instruments. In general, the study presents the results of the assessment instrument which is substantially less associated with the context of the life faced by learners and less facilitating learners in expressing the process of thinking and arguing. This is in contrast to the characteristics of the questions that the substance PISA contextual, demanding reasoning, argumentation, and creativity in the finish (Wardhani and Rumiati, 2011). So, that teachers can train learners in thinking to solve problems and apply in life, then the teacher should be trained. It can be started from the preparation of teacher candidates studying at college.

Physic Education Program Study is part of Department of Mathematics and Natural Science Education. Courses in the group Science (Physics, Chemistry, and Biology) equipped with basic knowledge in the field of science that is basic physics, basic chemistry, and general biology. Basic chemistry course is a compulsory course for students on all three study program. Through this basic chemistry course, students attend lectures using problem-based learning model. Students were trained how to solve the problem through a discourse given in lectures. Lecture began with a group

discussion to solve the problem, then proceed with a class discussion (Zulkardi, *et al*., 2014). Based on the above background, then in this paper presents how the results of the analysis of student answers to questions PISA with the Indonesian context.

2. Theoritical Background

Programme for International Student Assessment (PISA) an international assessment programs on reading literacy, mathematics, and science students 15 years old. 15-year-old learners have to follow the PISA assessment because it is considered to have the literacy skills of science such as analyzing, reasoning and science knowledge and skills to communicate effectively, and be able to solve problems and interpret science in various situations (OECD, 2003). In addition, students at the age of 15 years in most countries is nearing the end of compulsory schooling age that is considered to be a decision (Stacey, 2011).

PISA was organized by the Organisation for economic Co-Operation and Development (OECD). The purpose of PISA is to test and compare the achievements of children 15 years of age worldwide. Various countries participated in this assessment with the aim to determine the level of quality of a country is used as a reference in order to improve the quality and the quality of education in the cognitive domain, including Indonesia.

PISA assesses not only the knowledge that has been learned by the students, but also how students apply knowledge in new situations (OECD, 2013). Assessment PISA measures the extent to which a learner has the scientific knowledge and use that knowledge to identify questions, acquire new knowledge, explain scientific phenomena and draw conclusions based on evidence related sciences, to understand the characteristics of science as a form of human inquiry, showing awareness of science and technological, intellectual and cultural environment, and engage in issues of science and ideas of science as a reflective citizen (Scheicher, 2007).

This international assessment was first held in 2000 and is held every three years with a focus on different assessments of each implementation. In 2000, the main focus on

the PISA reading literacy. In 2003, the main focus on the PISA mathematical literacy. In 2006, the main focus on the PISA science literacy. In 2009, the main focus on the PISA reading literacy. In 2012, the main focus on the PISA mathematical literacy, while in 2015, the main focus on the PISA science literacy.

For assessment purposes, PISA consists of four interrelated aspects: 1) aspect of the context is to recognize real-life situations involving science and technology; 2) the aspect of knowledge is the understanding of nature based on scientific knowledge that includes knowledge about nature, and knowledge about science itself; 3) aspect of competence is demonstrated scientific competencies that include identifying scientific issues, explaining phenomena, scientific, and using scientific evidence; and 4) the aspect of attitude is showing an interest in science, support for scientific inquiry, and motivation to act responsibly towards the environment, for example, natural resources and the environment (OECD, 2012).

3. Method

The research is a descriptive study that revealed about the results of the analysis of student answers to similar questions PISA. The study involved 35 students of physical education class of the academic year 2014/2015 the University of Sriwijaya FKIP that administer basic chemistry courses as a research subject. Data retrieval tool in the form of equivalent PISA matter with the Indonesian context. Problem is accompanied by two discourses, which consists of five questions description. The data obtained were analyzed, presented in table form, described and interpreted.

4. Result and Discussion

In this study, presented two discourse that is the Ring of Fire and Forest Fire. Discourse about the Ring of Fire consists of three questions, while the discourse Forest Fire consists of two questions. Both the discourse presented closely related to the condition of the Indonesian state in the region of islands in the Pacific ring of fire ring. Then in the second discourse was closely related to the condition of Indonesia, especially with the South Sumatra area which has a lot of peat swamp regularly every year there is a fire, especially in 2015 a fire broke out very badly. The first discourse about the Ring of Fire and the accompanying three questions presented in the column below.

Discourse 1:

Ring of Fire

Indonesia is an archipelago located in the Pacific ring of fire ring. Therefore, there is still volcanoes that are still active. One is the mountain Sinabung. Sinabung eruption caused volcanic earthquake and damaging buildings, while the lava and volcanic ash impact on plants and animals in the vicinity. A phenomenon that can be found from the eruption of Mount Sinabung, among others yields declined or failed crops, animals, and plants a lot of dead people around must wear masks. Many people around the mountains is difficult to breathe because less oxygen availability, poisoning gases that are emitted by the mountains and the rain water is acidic.

Problem 1.1: Try to explain the impact of volcanic ash on the plant, so it can reduce result harvest?

Results of student groups to answer questions about the problem 1.1 was analyzed, described and grouped, and the results are presented in Table 1.

Table 1. Distribution of answers student to problem 1.1

No	Student Answer	Percentage
1	Volcanic ash is hot, which can damage and even cause the plant to die as a result of agricultural products declined.	55.54
2	Volcanic ash closes stomata of the leaves, so sunlight and CO_2 can not enter into the leaves that causes the process of photosynthesis is inhibited, resulting in decreased crop production.	45.45

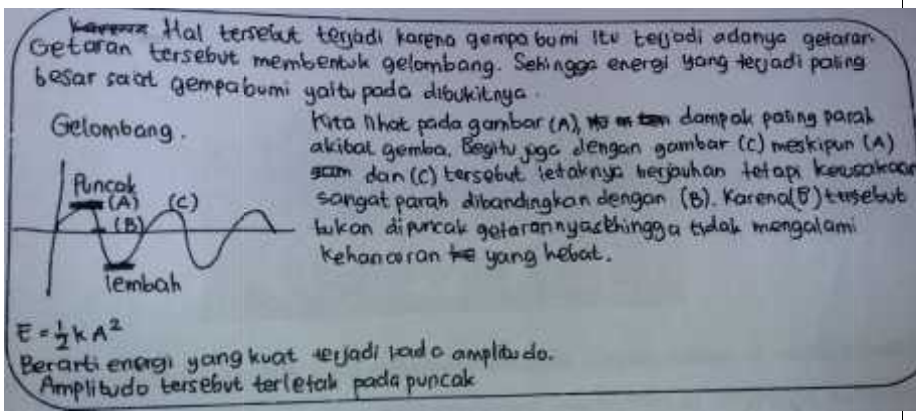
3	The acidity of volcanic ash can increase the pH of the soil, so the plants can not grow properly, resulting in crop production will decline.	27.27
4	Volcanic ash contains harmful substances such as sulfur, gold, silver, phosphorus, copper and quartz. Therefore the existence of these substances will disrupt the process of photosynthesis in plants, so the plants can not grow normally and crop production is not optimal. In addition, due to lack of O_2 and gas poisoning from volcanic causing plants become dead.	18.18

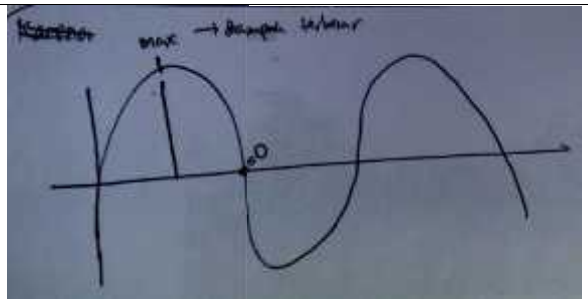
Based on the results presented in Table 1 above it can be seen that most of the group of students responded that crop production decreased due to the death of plants due to the effect of volcanic ash is hot. Plants exposed to the direct influence of volcanic earthquakes and fast process. A total of 45.45% of student groups responded that the ashes of volcanic earthquakes affect the photosynthesis process because the stomata of leaves covered by volcanic ash. Thus the supply of CO_2 for photosynthesis material obstructed and unobstructed sunlight also to reach chlorophyll, the photosynthetic process consequently hampered or even become stalled. This would will result in death of the plant. The rest of the student group answer was that ash from volcanic earthquakes affect the soil where plants grow. Influence of volcanic earthquakes that ash lowers the pH of the soil and make the soil becomes toxic to plant life. It could be resulted in plant death.

Problem 1.2: In the event of an earthquake, there are points that are severely affected by the quake. The impact of such destruction occurs periodically observed, there are areas that are not too far from the epicenter, but suffered great destruction. On the other hand, there are areas quite far from the epicenter, but suffered severe damage. How can these be explained?

The analysis of student answers in solving problem 1.2 are presented in Table 2.

Table 2. Distribution of student answers to problem 1.2

No	Student Answer	Percentage
1	This is caused by the earthquake occurred due to vibration. The vibration wave form. So that the greatest energy that occurs during earthquakes is peak of wave. We see in the picture most severely affected by the earthquake are images A and C. Even though A and C located far apart, but the damage is severe compared to B. This is caused by the region B is not at the peak of vibration so it does not ruin a great experience. 	36.38
2	This occurs because the impact of the earthquake damage is influenced by: 1) the depth of the earthquake, 2) the strength of the earthquake, 3) long vibration (earthquake), 4) the structure of the soil (soil conditions), and 5) the condition of the building	18.18
3	Areas bypassed by vibrations when the highest deviation of the wave, has maximum energy, so that the level of damage also reached a maximum. Conversely area traversed deviation 0 vibes have or not have a deviation, the impact of the damage is lower though situated close to the epicenter.	18.18
4	Only answered with image	9.10

	 Slab of land in areas that the earthquake is not in contact with the area of the earthquake so it does not ruin a great experience. Slab of land in remote areas with seismic regions in contact with the earthquake that suffered severe damage.	
5	Blank	18.18

Based on the results of the analysis of the answers in Table 2, it could be seen that there is a 36.36% answer to question problem 1.2 is associated with vibrations that form a wave. Severe damage caused by the earthquake were in areas bypassed by vibrations when the highest deviation from the waves. This was due to the region having the maximum energy, so that the level of damage also reached a maximum. Conversely area traversed deviation 0 vibes have or not have a deviation, the impact of the damage was lower though situated close to the epicenter. To clarify, the student answered with pictures.

There were 18.18% students answered only with images, with no intention of drawing a detailed explanation, however, could be understood from the drawing, the students wrote the greatest impact on the area of the peak of the wave. This showed that the damage was most severe in the area of the peak of the wave (max). Another group of students (18.18%) responded by linking the event of damage to the factors, among others; depth of the earthquake, magnitude, duration of vibrations, and whether or not touched by the earthquake plate.

Problem 1.3: In the volcanic earthquakes were accompanied by rain, rain water is usually acidic. Explain why it can happen?

Results of the analysis of the student group answers to the question to problem 1.3 are presented in Table 3.

Table 3. Distribution of student answer to problem 1.3

No	Student Answer	Percentage
1	Because of the volcanic ash contains chemical composition (SO_2, H_2F, HCl, CO_2, HCl, Cu and Fe), which is acidic, if it reacts with rainwater can cause acid rain	45.45
2	Because volcanic earthquakes generate a lot of gas, namely CO_2, sulfur, and other substances that then react with water molecules in the air so that the formation of acidic rainwater	27.27
3	Blank	18.18
4	Because it contains volcanic ash layers that cause irritation to the lungs, face and skin in both humans and animals. Easy acid leached layer so that rain water can contaminate the water supply of water at the affected locations. Abu acid can also damage the crop failure	9.10

Based on analysis of student answers showed that 45.45% of student groups stated that the volcanic ash is acidic because they contain certain chemicals, if the ash reacts with rainwater, then there was acid rain. A total of 27.27% of student groups to answer the acid rain occurs because the gases emitted from volcanic earthquakes is acidic, and if this gas reacts with rainwater, acid rain is formed. There was one group (9.10%) students who answer were not concerned with questions. The answer is more toward a result of acid rain on the environment. The rest, there were two groups of students (18.18%) did not answer the question. Based on the results of the analysis of the answers the student group could be obtained that only 27.27% of students answered correctly that acid rain was formed due to gas produced from volcanic earthquakes reacts with rainwater.

Discourse 2:

Forest Fire

Climate change impact on human life and plants on earth, for example due to the effects of prolonged drought caused fires such as fire peat swamp and Ogan Ilir people's plantation in South Sumatra. A phenomenon found many students are wearing masks, damage marsh vegetation, smoke causes the eyes become painful, even limiting visibility

Problem 2.1: Describe the impact of the destruction of marsh vegetation on the earth?

Distribution of the results of the analysis of student answer to question 2.1 is presented in Table 4.

Table 4. Distribution of students answer to problem 2.1

No	Student Answer	Percentage
1	Blank	54.5
2	Damage to populations of plants and animals in the swamp, loss of flora and fauna, and pollution	27.3
3	Damage to the swamp vegetation due to burning leads to reduced germplasm, weaken plants against pests and diseases	18.2

Based on the analysis presented in Table 4 it can be seen that the majority (54.5%) students did not answer the question. A total of 27.3% of the students answered the impact of damage to the marsh on earth is the destruction of the population (plants and animals) and pollution.

Problem 2.2: The haze very rapidly lately often causes disruption of aircraft landing at Sultan Mahmud Badarudin Palembang. Ministry of Research and Technology tried to cope with $CaCl_2$ liquid spray into the air, and the results are very significant decrease smog. How is the role of $CaCl_2$ fluid to the reduction of the smog?

Results of the analysis of student answer to problem 2.2 is presented in Table 5

Table 5. Distribution of student answer to problem 2.2

No	Student Answer	Percentage
1	Blank	36,36
2	$CaCl_2$ solution trigger the formation of clouds and rain as $CaCl_2$ solution can bind to CO_2 and water vapor (H_2O) contained in smoke.	36,36
3	Smoke was charged particles, $CaCl_2$ solution was also charged, so will bind, to form a heavier charged particles, because of the influence of Earth's gravity, the particles will fall, and the smoke is reduced.	18,18
4	$CaCl_2$ solution serves as a smoke absorber	09,09

on the results presented in Table 5, it can be seen that as many as 36.36% of the students did not answer questions. A total of 36.36% of the students replied that $CaCl_2$ solution binds to CO_2 and H_2O (g) contained in the smoke. Smoke concept has not been understood by the students, so they declared that water vapor contained in the fumes. Only 18.18% were students who answered according to the desired response pattern, ie $CaCl_2$ solution that would bind to charged particles of smoke, forming charged particles that are larger and because of the influence of Earth's gravity, these particles fall to the earth's surface.

5. Conclusion and Remark

Based on the research that has been done can be concluded that the equivalent of five questions PISA completed by the student, a row of question number one to number five percentage amount that the correct answer is 54.54%, 36.36%, 27.27%, 27.27% and 18.18%. The average percentage of answers that could not be answered correctly and in accordance with the key to the answer is as much as 67.28%.

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