Students’ difficulties in solving the mathematics word problems with the context of Education for Sustainable Development (ESD)

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Abstract. The purpose of this research was to know the student’s difficulties in solving mathematics word problems with the context of Education for Sustainable Development (ESD). ESD is an educational concept proclaimed by UNESCO which purposed to fulfill the needs of the present generation without risking the needs of the next generation. In other words, ESD could be said to be an effort to achieve sustainable development. There are 3 ESD contexts: environment, economy and culture. ESD concepts are expected to be integrated in learning, including mathematics learning. Therefore the learning method, teaching materials, learning media and evaluation used should support the implementation of ESD. This research was a qualitative research involving 30 students of SMP grade VII in one school in Bandung. Data was obtained from observation, interview and test. The test was about the number and comparison material. The result of this research was that students had difficulties in solving word problem. First the students had misinterpretation of the problem. Second, student was lack of comprehension of the problem posed. Third, students were not careful and also having an error in interchanging values.

1. Introduction
Education for sustainable development was a concept of education launched by UNESCO in the framework of sustainable development. According to [1] on the World Commission on Environment and Development Sustainable development is a development that meets the needs of the present without sacrificing the ability of the future generations to meet their own needs. In other words, sustainable development is not only think the good impact now but also think about the good impact for the future. The concept was launched in order to solve global problems that occur in the world such as lack of clean water, the problem of plastic waste, global warming, energy shortages and so others. Overcoming this problem can not solve instantaneously but need a plan and effective ways. To solve this problem involves all people, including youth at an early age or at school, because of it, UNESCO emphasize that ESD is applied in schools. Adapted from the Asia-Pacific regional report also mentions that ESD is seen as an approach in education to develop values that support sustainable development with the aim of helping humans learn about knowledge relevant to values, developing healthy habits, and lifestyle that will lead to sustainable development for the whole society [2].

The importance of the application of the concept of ESD in schools, the school learning should be integrated with the concept of ESD, including the learning of Mathematics. Therefore, in the teaching
of Mathematics, both methods of learning, teaching materials, instructional media or evaluation / assessment of integrated ESD. Math teachers should be able to provide a quality learning experience for students that include ideas / ideas about sustainability development in a mathematical context, without sacrificing the mathematical content they must master [3].

Integrated ESD learning mathematics is learning mathematics that uses the context or perspective of ESD. There are three ESD contexts, namely social, cultural, environmental and economic [2]. Mathematical learning should not be separated from the economic, cultural and political context of society [4]. According to CORD in, learning where the context will make the learning becomes meaningful [5]. Learning Mathematics Integrated ESD does not only associate with the context of mathematical concepts but also use the concept in solving the problems that exist in the life.

Associating with a mathematical concept in the context of life is not easy for students. According to there are several obstacles faced by students [6]. First, most students in the school cannot make the connection between what they learn and how this knowledge will be applied. Second, the students have difficulty understanding the academic concept (such as mathematical concepts) when they are taught with traditional methods, but they are very necessary to understand the concepts as they relate to the world of work in which they will live. Third, students have been expected to make their own these relationships, outside the classroom activities. Beside, students should be motivated to or learn to study mathematics and mathematical modeling in particular [7]

Math problems associated with a context is usually in word problem form. This research is very important to do as a first step to determine the extent to which the student's ability to solve the problems of Mathematics with ESD context. In this study, it will try to develop a word problem about the context of the ESD, and then see how the students' answers as well as the difficulties faced by the students in solving word problem. The term "difficulties" in this section's title refers to obstacles that cause errors or mistakes made by students [8].

Previous research related to ESD is the research conducted by namely on the implementation of Curriculum-Based Education for Sustainable Development (ESD) in SDIT International Luqman Hakim Yogjakarta [9]. Rohma revealed that in the SDIT apply the concepts and values of ESD in daily lessons.

2. Research method
The research method used in this study was a qualitative research method. The study involved 30 people junior high school student in one of the junior high schools in Bandung. Data were obtained from observation, interview and test. Data were analyzed qualitatively that the cycle of data reduction, data display and verification / conclusions.

3. Results and discussion

3.1. Student's difficulty in understanding word problem based on interviews with teachers
Based on interviews with one of the teachers of Mathematics it was obtained information that in general students were able to solve the problems that were algorithms and procedural form, but the students had difficulties in understanding the word problem. Student difficulties in solving word problems are caused by several factors. The first factor that is students do not understand the concept of the material. The second factor is the language students lack understanding about the content of the word problem itself. This could be because students are less familiar in solving the story, especially about problem solving question.

3.2. Student’s difficulties to solve mathematics word problems based on test results
Students were given tests in the form of questions in word problem form. Then, the test results were analyzed. There were some difficulties experienced by students when answering questions. At the time the question was given to the student, the student admitted that the question of the long form of the text made them lazy to read it. Even before they started thinking about the answers they had already said that the problem was hard to do.
According to Aljupri, there are six mistakes made by students in solving Mathematical story [8]. The error is 1) Misinterpretation of the Problem; 2) Lack of comprehension of the problem posed; 3) Incorrect use of Operation; 4) carelessness; 5) Values interchanging; 6) unfamiliar words. Meanwhile [10] revealed that the main Difficulties encountered by students who deal with word problems concern the transforming problems into mathematical models.

3.2.1. The difficulties experienced by students to solve word problems in text 1

a. Text 1
Mr. Zahariyah looked exhausted after picking up plastic waste from a river embankment in the seaside village Aquarium Jakarta. Today it is she getting three sacks of used plastic bottles and glass beverage containers, more than usual.

"Waste of the children who like litter into the river". Pak Zahariyah said bottles and plastic cups were flowing to the coast came from residents around the former beverage packaging littering rivers flowing into the sea to Jakarta.

According to researchers from the University of Georgia Dr. Jenna Jambeck - published in the journal Science (sciencema.org) February 12, 2015 - Indonesia dispose of plastic waste as much as 3.2 million tons, and was second as contributors plastic garbage into the sea after China. Jambeck explained that plastic is not degradable and will turn into droplets smaller in the long term. "Plastics are smaller and can damage the environment," explains Jambeck.

Waste reduction at sea must be accompanied with waste management on land. Dwi Sawung of the Association of Zero Waste Indonesia said that the problem of garbage in the sea in Indonesia is actually derived from the absence of waste management on the ground, especially in big cities. "Especially in the Javanese population is enormous, the cities there is no waste management is good.

Answer the questions below correctly!

Problem 1
Recently, the government is currently reviewing the use of plastic waste as raw material for additional manufacture of the highway. it can reduce the amount of plastic waste and also reduce the cost of road construction, such as in India. if for one kilometers of road with a width of 7 meters require a mixture of 3 tons of plastic waste. So how many kilometers long road that can be made with 3.2 million tonnes of waste plastic waste? Write down the result as a positive exponential number!

Students’ answer

![Figure 1](image.png)

Figure 1. Student’s answer for question number 1.

From the student’s answers, the student difficulty was misinterpretation of the Problem. Than it was supposed that the long road was not wide road. So the comparison should be:

\[
\frac{1}{x} = \frac{3}{3,200,000}
\]
Problem 2

From the above discourse is known that Mr. Zahariyah clean up plastic waste once in 3 days. For example, it is known that a pack of Toni, his sister pack Zahariyah, clean up trash once in four days. Mr. Zahariyah and Mr. Toni clean up trash together on December 22, 2017. On what date Zahariyah pack and pack Toni will clean up trash together again?

Students’ answer

From the students’ answers, students do a mistake in determining the result of $2 \times 2 \times 3$. In other words, the students made a mistake in determining the result of the multiplication. In addition, students are not appropriate in calculating the date. Student should count 18 from December 22, 2017, not from January 1, 2018. So the fault of students in solving this problem was that students were not careful and also having an error in interchanging values.

Students’ answer

Student had been able to understand the questions correctly and determine the least common multiple. However, students were less precise in calculating the rest of the day. Supposedly the remainder is 3. So Mr. Zahriya meet with his brother on January 3, 2018. So the mistake that made by students was less accurate in calculating the date and the difficulty in interchanging values.
Problem 3
Suppose the number of plastic waste being dumped by a family in the village Punggasan in a week is 3 kg. Suppose that in the village there are 48 families. What amount of waste dumped in one year. Make a whole integer positive exponential.

Students’ answer

Figure 4. Students’ answer for number 3.

From the students' answers were visible only students simply multiply the numbers that exist on the matter. Error student was Lack of comprehension of the problem posed. Students do not understand the intent cider just about so just multiply the numbers were there.

Other students’ answer

Figure 5. Students' answer for number 3.

From the students' answers, the students already understand the intent of the matter but students were less precise in understanding that the waste produced was 3 kg per week. The student Supposed to count one year $144 \times 52 = 7488$ kg, not multiplied by the number of days in one year. This means that students have understood the problem and what is being asked in the question. However, students are less scrupulous in answering.

b. Text 2
Nina wants to make cakes for sale. The cake will be made is dried bean cake. He's on the internet to track down the necessary ingredients to make the cake. As for the materials needed and the price of each is presented below.

| No | Ingredients make peanut cake. | Weight   |
|----|-------------------------------|----------|
| 1  | Wheat flour                   | 2 kg     |
| 2  | Groundnut                     | 500 gr   |
| 3  | Refined sugar                 | 750 gr   |
| 4  | Cooking oil                   | 1 kg     |
| 5  | Egg                           | 3 (for spread) |

| No | Ingredients Material price. | Material Price |
|----|----------------------------|----------------|
| 1  | Flour                      | Rp.8.500/kg   |
| 2  | Peanuts                    | Rp.25.000/kg  |
| 3  | Sugar                      | Rp.20.000/kg  |
| 4  | oil                        | Rp.13.000/kg  |
| 5  | egg                        | Rp.1.500/egg  |
From these materials obtained as many as 264 fruit cake. The cake will be wrapped into the box. Each box contains 24 pieces of cake. If a box is sold at a price of Rp.12.000,00. Does Nina earn a profit / loss? What are the advantages / disadvantages obtained Nina?

Student answers

![Image](image_url)

**Figure 6.** Students’ answer for question number 2 of text 2.

From the students' answers can be seen that students do not understand the purpose of matter, so that students are less precise in operation.

4. Conclusions

From the description on the research results can be concluded about the difficulties experienced by students in solving story problems. First the students had misinterpretation of the Problem. Misinterpretation can be caused by students that do not understand the concept of the material. Understanding the concept is the main model in solving Mathematics problem. Second, student was Lack of comprehension of the problem posed. Students do not understand the intent matter. It occurs in connection with the literacy skills of students in understanding about the problem of what is given and what is asked in question. Third, students were not careful and also having an error in interchanging values.

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