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UNFINISHED STUDENT ANSWER IN PISA MATHEMATICS CONTEXTUAL PROBLEM

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Abstract

Solving mathematics contextual problems is one way that can be used to enable students to have the skills needed to live in the 21st century. Developing mathematics contextual problems is important to support that skill. After the product valid and practical, student should answer that product properly. Completion contextual problem requires a series of steps in order to properly answer the questions that are asked. The purpose of this study was to develop the mathematics contextual problem and determine the steps performed students in solving contextual mathematics problem. The results showed that 75% students can not solve contextual mathematics problems precisely (unfinished). Students stop and feel that it was completed when they are able to solve problems mathematically, but mathematal solution has not answered the requested context.

Keywords: *mathematics contextual problem, developing, 21st century, unfinished*.

INTRODUCTION

A contextual mathematcis problem has be the center of education in many countries. It can be seen from using Program for International Student Assessment (PISA) by the OECD countries to assess the development of students (OECD, 2010). Indonesia began following the PISA in 2000. For 4 times its participation, Indonesia had low result (Stacey, 2010). One of the factors that cause low grade is the student habit in solving contextual problems at the school. Problems at commonly school is different with PISA problem because it uses a contextual problem.

The use of contextual problems actually started from the philosophy of Hans Freudenthal "Mathematics as human activity" (Freudenthal, 1973; Lange, 1987; Gravemeijer, 1994; Zulkardi, 2002; Wijaya, 2012). That sentence has a meaning that mathematics was very close to human life. Mathematics exists because of human activity so that every human activity can not be released with mathematics. Therefore, the questions on the PISA mathematics are based on real world problems and hone student thinking in solving the problem (Stacey, 2012).

The importance of contextual problem given to student is relevant with the goals of 21st century education. In the 21st century, complex society requires people who are capable of analyzing and responding to issues in a constantly expanding knowledge-based world. it needs people who are able to analyze and respond to real life problems quickly and accurately (Baimba, Brown & Hardimah, 2008). Students need to exercise solving real problems that require reasoning, clarification, argument or other mathematical skills because it associates in the future that they will be able to contribute improvements in society (OECD, 2009; OECD 2010).

National Research Council (1990) in Wijaya (2012) formulated four goals of mathematics education when viewed from the position of mathematics in a social environment. (1) Practical purposes related to the development of students' ability using mathematics to solve problems in everyday life. (2) Society porpuses orientate in students' ability to active and intelligent participation in public relations. (3) Professional goals to prepare students to plunge into the world of work. (4) Cultural destination regards mathematics as a cultural product.

Schmidt in (Checkley, 2007) says that if citizens are not educated well enough in math and science and providing our workpalce background, it will affect the future of the country and the type of work that can be obtained by students. The purpose of education in Indonesia also wants students to have the ability to understand mathematical concepts, use reasoning, solve problems, communicate ideas, and contribute the usefulness of mathematics in real life (Depdiknas, 2001).

Fulfilling the mathematics education purpose is important, especially about the usefulness of mathematics in order to have the life skills to solve real problems so studiying the PISA problem in one of the alternative solution. Literacy skills in the PISA mathematics means showing the capacity of each individual to formulate, apply and interpret mathematical situations in many situation. Individuals thinking include making mathematical reasoning and using concepts, procedures, facts and tools to describe, explain and predict an event. It helps the individual to understand the rules that make mathematics as a reference to the real life and to make judgments and decisions on ourselves as citizens. Therefore, students must familiarize with the PISA mathematics problems. However, many students cannot able to finish up such questions. It can be seen from Indonesia result in PISA participation. Problem should be solved by the mathematical process namely formulating mathematically situation; employing mathematical concept, fact, procedures, and reasoning; and interpreting, applying and evaluating mathematical outcomes (OECD, 2010).

This research method is design research which has focus in developing product. Characteristic development research has almost the same as design research (Akker, 2006). The research is aimed at the developing contextual mathematics problem with PISA models in valid and practical and used it to determine student's ability to solve real problems in mathematics then they are given several contextual mathematics problems. Students are given about 10 minutes to answer each question. Student outcomes will be analyzed based on a scoring rubric that has been made. The research conducted in two phases, preliminary or preparatory stage and the protoyping stage (Nieveen, 2006; Plomp, 2007). In the prototyping phase flow evaluation using formative evaluation, it has 4 phases namely self-evaluation, expert review and one-to-one, small group, and field test (Figure 1).

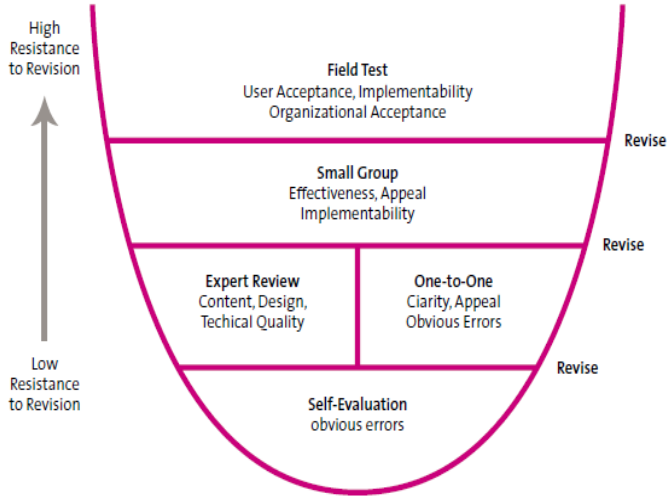

Figure 1. Phases of formative evaluation (Tessmer, 1993; Plomp, 2007)

MAIN SECTION

Developing problem

The preliminary stage, researcher determines the place, subject, and procedure of study. Researchers also design draft of the initial prototype of the questions that will be developed. Scoring draft, card draft, guided line draf were also made by the researcher in this stage. In the second stage of this study design is prototyping by using flow formative evaluation. Formative evaluation phase flow using 4 stages of the self-evaluation, one-to-one, and expert review, small group and field tests.

1. Self Evaluation

At this stage of self-evaluation researchers examine, analyze and revise draft prototype designed in the preliminary stage.

2. One-to-one and expert review

At the second phase, one-to-one and expert review conducted in parallel. One-to-one evaluation used 6 students tested at different times. Procedure given in one-to-one is student answer the problems in 60 minutes after the students work on the problems the students will be given a questionnaire and after that interview given. Evaluation in one-to-one focuses on clarity, simplicity and effectiveness of the questions.

Expert review serves to determine the validity of the problem based on the content, construct and language. An expert chosen is a professor of State University of Surabaya. Prof. Dr. Siti M. Amin, M.Pd, reviewing math concepts, context and language used weather it is in accordance with the PISA characteristics or not. The second expert is Dr. Ross Turner, he is director of the Australian Council for Educational Research (ACER). His judgement has meaning that product is valid and practical. This is the jugdement by expert Dr. Ross Turner following comments is given:

> "I like some things about your approach. The stimulus seems quite practical and realistic, and the idea of using photographs like this is good and is similar to the approach we have taken in PISA. I think the problems are heading in the right direction to fit with the PISA framework. BUT, I felt that some of the questions were a bit unrealistic, or made assumptions that might not hold."

From the comments of Dr. Ross Turner suggests that the design has been made it seems practical and realistic. He liked the approach used in developing PISA problem. The use of images is looked good and according to the PISA approach. However, there are some little things that do not fit the PISA framework as like little unrealistic and assumptions used may not be suitable.

3. Small Group

In the small group stage, procedure given to the students is questionnaires and interviews. Student response data were assessed and performed statistical tests.

4. *Field test*

In the field test, the results of the small group that is the third prototype was tested in grade IX 2 SMP Negeri 1 Palembang. The procedure of field test is that students are given a problem. Problem is answered about 60 minutes. After that student was given questionnaires sheets and answered about 10 minutes. After questionnaires, six student selected randomly are given the interview.

Analysis student answer

This is the problem that already develop and answered by student.

Tissue

Rudi told his father to buy tissue paper at the store because tissue in his house is run out. The right image is a tissue that is sold in supermarkets. Tissue has 10 cm height. Tissues will be filled on the orange tissue box on the left Figure.

Question

How much it costs to fill the empty tissue box? Explain!

The next question is about fruits market.

In the market there are two mango sellers. First type is called A. They sell Rp. 3.000 per fruits. Second type is B, they sells Rp 750 per 100gr. The weight of mango on average is 400 gr.

Question

Which buy is better value for money? Show your mathematics reasoning?

The two questions above each have a maximum 5 point. Problem tested to 30 students in junior high school. The results of the students' answers are analyzed by focusing at the process.

On the tissue question, the percentage of students with a maximum value is 0.76%. It shows that the students can answer questions easily. Otherwise when it is seen from the students who received a 4 point it has 17 students. This shows that the students' answers are less than the maximum. Nearly half of students obtaining 4 point because they can not inteprete and apply the answer that they recieved to the context problem. Students calculate and get Rp. 24,510, whereas if it is returned to the real problems as a buyer, Rudi certainly buy 2 pacs tissue at the supermarket to fill the empty tissue box at home. So the cost is Rp.25,800. Figure 1. Describe an unfinnish answer.

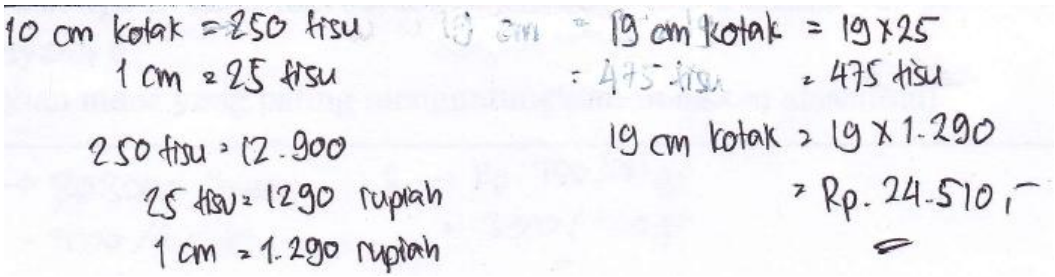

Figure 1. an unfinish answer for tissue problem

In Figure 1, it shows that students can calculate mathematically correct, when viewed from the PISA mathematics process, they are able to formulate and employ concepts, facts, procedure mathematically. However, they have not been able to interpret the answer to evaluate whether the response obtained is required to answer the problem or not.

While in figure 2. It shows students correct answers. Students can answer the problem precisely correct because it is connected to real-life contexts requested.

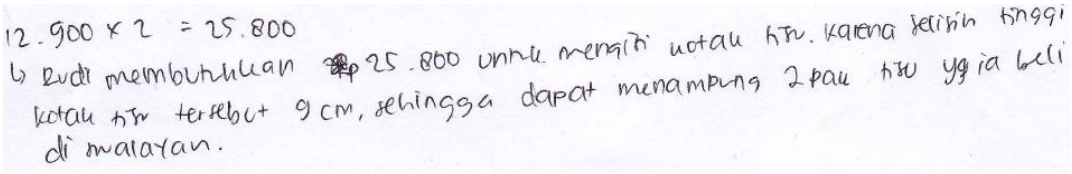

Figure 2 correct student answer

Students argue that 1 pack tissue in market has 10 cm height and an empty tissue box has 19 cm height. So to fill the tissue box, Rudi must purchase 2 pack tissues. If students are able to answer the problem, it indicates that the students are able to use all three PISA mathematical processes that is formulating, employing and interpreting

Problem on tissue is classified to the level 2 (prediction). Level 2 categorizes on reproductive competence cluster. It is still relatively low difficulty. In unit of shopping fruits, it categirzes in level 5 prediction. It is more complex and need deeper analysis.

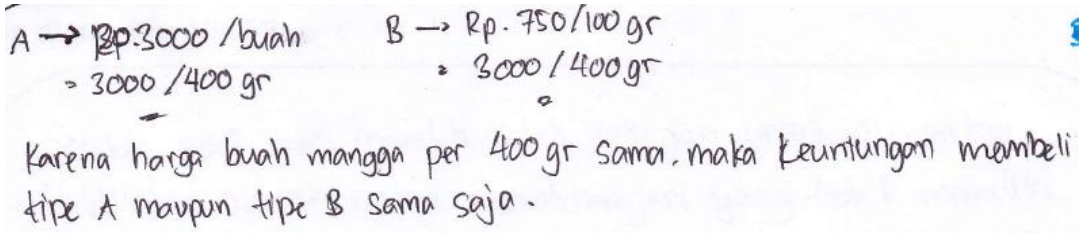

Figure 3. unfinish anwers in sopping fruits

Student answer in figure 3 indicates that student student has not been able to analyze and connect the solution with the real-life situation. When the seller sells mangoes using size per 100g then the price will be calculated is each weighed heavy. Therefore, if the mangoes weighing more than 400 g. So the price paid will also be more than Rp 3,000. Students are only focused on the calculation (Figure. 3) that the results of calculations show the same value. The same error occurred in this matter. 80% students can not finnish this problem. Students tend to satisfied with the steps taken when a step mathematical resolution of the situation do not answer a given context. Analysis of fruit shopping problem in correct answer can be seen in Figure 4

Figure 4. correct student result of fruit shopping problem

In figure 4, students answered correctly. Students estimates that by purchasing a mango a piece then the consumer will be more profitable because they can choose a big mango fruit may weigh more than 400 grams at a fixed Rp.3000. The key importance of shopping fruits is a problem in understanding the meaning average. Average spending on the mango fruit problem has meaning that it may vary on weighs 400 grams, so there mango weighs precisely 400 grams, less than 400 grams or more than 400 grams but the average is still 400 grams. Student response in Figure 4 shows the exact reason in analyzing the matter although the calculation has the same price for each mango but they can understand the situation well. Students

are able to use all three PISA mathematics process (formulating, applying and interpreting).

The two problems above have average of students answered correctly by 25%. This shows weaknesses in analyzing and evaluating students' answers to context associated with the situation demanded. Students unfinish answer because it was stopped completely after obtained a solution of mathematical calculations without considering the context.

CONCLUSIONS AND RECOMMENDATION

From the results and analysis above, ti can be concluded that it had been made some mathematics contextual problem with valid and practical and also junior high school students are less able to answer contextual questions. Students stop in mathematical calculations without looking back what has to answer many of the requested context so it became unfinnish answer. The low value Indonesia mathematics PISA may occur due to the lack of students in learning or excercise contextual problem. Students are not familiar with solving contextual problems and they satisfied when the mathematics calculation has been obtained. Therefore it is recommended that teachers often use contextual problems in learning or in the learning assessment because became the mastery of soving contextual problem can prepare students to live in complex society and it is the purpose of mathematics education.

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