DEVELOPING MATHEMATICS SELF-CONCEPT IN ELEMENTARY STUDENTS THROUGH PROBLEMS BASED ON PISA ASPECT

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ABSTRACT

Mathematics self-concept, which can be defined as student ratings of their skills, ability, enjoyment and interest in mathematics, is seen as an important factor in mathematics education. In this context, the purpose of this study was to investigate the elementary school students’ mathematics self-concept in solving problems based on PISA aspect. Formative evaluation was used in this study. The research sample were composed of 90 students, determined by randomly from in a secondary school in Banda Aceh and Aceh Besar in the second semester of 2016-2017 academic year. Data were collected using the result test by solving problems and qualitative analyze. The results of the analyses indicate that there is a significantly hard for students in Banda Aceh and Aceh Besar explain their skills and ability in solving problems based on PISA aspect that connect to reality life. Their habits is solving common problems that can be answer by calculate the number or manipulate the formulas. They have not become accustomed to solve some problem that use more than one concept. Furthermore, there was a significant rank of Indonesian students in PISA. In the light of the findings of this study, the researchers have developed suggestions to the teacher to use reality life to build the mathematics concept.

Key Words: mathematics self-concept, PISA, development research.

INTRODUCTION

Education is an important activity in life to improve the quality of human resources in ensuring the survival and progress of a nation. Improving the quality of human resources is of great interest to be much more urgent to be realized, especially in the face of competition of ASEAN Economic Community (MEA) and global competition. Therefore, improving the quality of reliable human
resources who have critical, systematic, logical, creative thinking and a willingness to cooperate effectively from an early age is a matter of great concern. One of the efforts to improve the quality of human resources that have thought as mentioned above can be generated from educational institutions, especially in schools.

PISA (Program for International Student Assessment) is one of the international programs to measure the educational success of a country. PISA focuses on a three-year literacy contest that assesses the ability of 15-year-olds to apply the knowledge and skills they have learned in school to problems that are often faced daily. PISA was organized since 2000 by the Organization for Economic Co-operation and Development (OECD) which was attended by more than 70 countries in the world including Indonesia. Tjalla (2009: 2) mentions that the PISA study conducted by OECD and Unesco Institute for Statistics measures the ability of students at the end of compulsory education to know the readiness of students to face the challenges of today's knowledge society. Assessments undertaken in future-oriented PISAs, which test the youth's ability to use their skills and knowledge in dealing with real-life challenges, do not merely measure the capabilities listed in the school curriculum.

Indonesia's involvement in PISA is one of the efforts to see how far the development of education programs in Indonesia is compared to other countries. OECD (2007, 2010, and 2013), Tjalla (2009: 18), Wardhani (2011: 1), and Putri (2011: 2) say that Indonesia itself has followed PISA since 2000, 2003, 2006 and 2009 with results Does not show much change in every part. In the PISA survey 2003, in the field of mathematics more than 50 percent of Indonesian students reached the lowest level with scores below 358. In the 2006 PISA survey, Indonesia's ranking for mathematics fell from 38 out of 40 countries (2003) to 52 out of 57 countries, With the average score falling from 411 (2003) to just 391 (2006). Then in PISA 2009 Indonesia only ranked 61 out of 65 participants with an average score of 371, while the international average is 496. And in PISA 2012 Indonesia occupies the bottom with the value of 375 while the international average is 494 (OECD, 2013 ).

The PISA framework 2012 explains that the Mathematics PISA framework has three dimensions: (1) content, (2) context (situation), and (3) competency cluster. Problem PISA developed based on 4 content, the four content includes: Shape and Space,
Change and Relationship, Quantity, and Uncertainty. One of the fourth content about PISA is the content of Change and Relationship. The PISA questions on the Change and Relationship content are thoroughly focused on the need for quantification. Important aspects include understanding of relative size, recognition of numerical patterns, and the ability to use numbers to represent the quantitative attributes of real-world objects. This content is also related to algebra subject matter. Mathematical relationships are often expressed by equations or relationships of a general nature, such as addition, subtraction, and division. The relationship is also expressed in various algebraic symbols, graphs, geometric shapes, and tables. Since each symbol representation has its own purpose and nature, the translation process is often very important and decisive in accordance with the situation and the task to be done.

METHODS
This research is a type of research development or development research. According to Sudjadi (2003: 164) research and development or Research and Development (R & D) is a process or steps to develop a new product, or refine an existing product, which can be accounted for. According to Tessmer (1993) this type of research is a formative evaluation consisting of three stages, namely:

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<tr>
<th>Formative Stage</th>
<th>Operational Measures</th>
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<td><strong>Self-Evaluation</strong></td>
<td>Analysis: perform student analysis, SMP / MTs curriculum, indicators used, and analysis of PISA questions and KLM issues related to change and relationship. Design: designing problem tools that include lattice and mathematics model of PISA content change and relationship. Descriptions are done with regard to content, constructs, and language. Result: Prototype I</td>
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<td><strong>Expert Review</strong></td>
<td>Validity: performed against prototype I by validator in terms (modified from Novita, 2012): 1. Content: the form of questions and indicators in accordance with PISA and the curriculum. 2. Construct: support literacy, rich with concepts, invite further development concepts, clear. 3. Language: according to EYD, not ambiguous, no</td>
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410
Developing Mathematics Self-Concept In Elementary Students Through Problems Based On Pisa Aspect. (Ahmad Nasriadi, Intan Kemala Sari)

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<th>Experiment Type</th>
<th>Description</th>
<th>Results</th>
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<td><strong>One-to-One</strong></td>
<td>Experiment: three students (from different levels of ability) were asked to work on the prototype I design. Students were also asked to write comments about the questions. Answers and comments were made in revision about prototype I.</td>
<td>Result: Prototype II is valid</td>
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<td><strong>Small Group</strong></td>
<td>Experiment: six students (different students with one-to-one students, with different levels of ability) were asked to answer the prototype II question. Next comment on the matter concerning their understanding of the intent of the question on the comment sheet provided.</td>
<td>Result: Prototype II is valid and practical</td>
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<td><strong>Field Test</strong></td>
<td>Field test: a group of 15-year-old students in Banda Aceh were given a problem to determine the effectiveness of the problem. At this stage students are asked to answer the mathematical problems of the PISA model in the changed and relationship content that has been developed and write comments on the questions on the provided sheet. The product tested on the test field must be a product that meets the quality criteria. Akker (in Kamaliyah, 2012) suggests that the three quality criteria are: validity (from validator and math teacher), practicality (easy use and can be used to see legibility and clarity about PISA models developed by students) and effectiveness.</td>
<td>Results: PISA issues content change and relationship.</td>
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Based on the methods and procedures above, the data collection techniques used in this study for each stage are:

1. **Walk Through**

   In the expert review stage, walk through is done with the validator, then the validator provides suggestions or feedback about the clarity and suitability of the context used. According to Tessmer (1993) the procedure used is as follows:

   a. At first the researchers gave the results of making mathematical problems in the PISA model of content change and relationship that has been made to the validator.
b. The validator evaluates all the questions, and then gives input.
c. The researcher corrects the questions by considering comments and suggestions from the validator.

Researchers conducted a descriptive analysis by revising based on walk through or validator records. The results of this analysis are used to revise the problems that have been made by researchers on prototype I so obtained a valid question.

2. Documentation

At the self-evaluation stage the document used is a curriculum in accordance with the curriculum of 2013 and the syllabus of SMP / MTs and PISA model issues content change and relationship. The researcher then designed a question set that included a grid and a PISA model based on content, constructs and language. So at this stage obtained a prototype I in the form of a mathematical device model PISA on uncertainty and data.

Document used in one-to-one in the form of answer and answer sheet and student comment sheet for prototype I. The analysis was done on student comment sheet and answer sheets of class VIII SMP Negeri in banda Aceh consisting of three students with high mathematical ability, Medium, and low to see the practicality of mathematical problems in the PISA model in the content of change and relationship made by the researcher that includes the clarity and legibility of the question.

Documents used in the small group stage include questionnaires, student comment sheets and student answer sheets for prototype II. The analysis was conducted on student comment sheet and answer sheet of VIII students of SMP Negeri in Banda Aceh at small group of six students (two high, two medium and two low) to see the practicality of prototype II. In the self-evaluation stage, the researcher analyzed the device of the first prototype that has been produced to find out whether the question device developed is in accordance with the junior high school / MTs level, the
curriculum applied in the SMP / MTs, and the characteristics of the PISA model.

In the one-to-one phase the documents used to analyze the practicality of the PISA model mathematical problems in prototype I are student commentary sheets, student answer sheets, and observations and findings during the students' work on the questions. The results of this analysis are also used to revise the prototype I. In the small group stage, the documents used to analyze the practicality of the PISA model mathematical problems in prototype II are student commentary sheets, student answer sheets, and observations and findings during the students' work on the questions. The results of this analysis are also used to revise the prototype II.

3. Test

In the field test stage, prototype III is used to obtain data about the clarity and readability of the questions by the students, so that the mathematics model of PISA obtained in the uncertainty and data content has been developed which is valid and practical. Analysis of test results conducted to determine the clarity and legibility of the development of PISA model content change and relationship in students.

RESULTS AND DISCUSSION

This study has developed ten questions in four contexts: personal, work, social and scientific. The developed problem refers to the real-life situation and incorporates elements of Aceh culture. This is done to build a self-concept in solving math problems. Whether we realize it or not, using the existing circumstances of everyday life brings out ideas for students to build and solve problems.

The concept of the first problem is about the selection of typical souvenir of Aceh. There are several offers that require low-thinking students to solve the problem using simple algebraic concepts. While in the second context is a matter with the context of work. In such matters students are asked to think more highly about the fulfillment of work needs and rewards that can be obtained from his job. In addition, in the issue raises a positive character where the problem does not cut the worker achievement through the delays but
Developing Mathematics Self-Concept In Elementary Students Through Problems Based On Pisa Aspect. (Ahmad Nasriadi, Intan Kemala Sari)

through rewards that can be obtained in accordance with the skills that are owned. In the context of the problem when about the distribution of basic foods ahead of Idul Fitri holidays. In that case teach generous characters. Nevertheless, in this case still requires critical ability in determining problem solving because it involves positive traits developed in the life of society. The fourth context is a problem with the category of ability with high-level problem. The problem chosen is about the selection of fuel that can save costs and maintain the durability of the vehicle engine. Among the problems developed are already qualified valid, practical, and reliable. The fulfillment of these requirements has followed the development rules by Tessmer.

CONCLUSION

Learning is a process that involves the reorientation of previously possessed knowledge to build a new concept that will be owned afterwards. To construct the new concept, it is necessary to have real contexts that the learner recognizes in order to be connected with the logic and reasoning. So also in the learning of mathematics, to build a mathematical understanding is not formed by memorizing the formula but by involving real problems in everyday life to find solutions and problem solving so that raises mathematical notations derived from the language of the problem. Learning without problems means just building memory and minimal concepts. For that learning mathematics need the development of problems that support the formation of a concept of understanding that at a certain level called formal concept called.

This research has developed a valid, practical, and legible qualification that was conducted over a period of five months. Still need a reliability test that must be done so that the problem becomes perfect and can be used for the wider educational community. In addition, the question can be an input to be a draft textbook in the appropriate material. For that, this research is still said far from perfect considering the need to do one more pilot phase of field trials on a wider group and statistical reliability test so that the results of research can be justified.

From the study we got the students perception to the problems as follow. Students feel challenged and feel able to solve the problem posed because the context of the problems they recognize, real, and
close to everyday life. Students feel that they can solve problems without using difficult formulas because the proposed context is questioned only in terms of everyday reasoning without having to use standard formulas and complex symbols. Students can explain the information in the problem, understand the story line, but do not write the description of the problem solving clearly. Students are not accustomed to solving reasoning problems, therefore the written answers from students are concise, and students also have verbal limitations in explaining the results of the answers. Students can solve PISA equivalent problems but because students are not accustomed to solve problems that are contextual then the student difficulty in writing and explain it verbally in detail, but students can explain in detail what information and what intentions exist in the proposed problem. Students feel that everyday life has something to do with mathematics. This simply changes the students' perception that mathematics is a difficult lesson and only limited to theories to manipulate numbers in solving problems.

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