

## Development Mathematical Problem Solving Problems At Junior High School

Nila Kesumawati  
*Departement of Mathematics Education*  
*PGRI University of Palembang*  
*Gotong Royong Plaju Palembang, email: nilakesumawati@yahoo.com*

### abstract

This is development researched which aims at (1) constructing valid and practical mathematical test items based on some problem-solving skills for junior high school students, and (2) finding out the potential effects of such test items after their third or final prototype construction. Those test item were tested to 41 ninth grade students of the state junior high school number 9 in Palembang in academic year 2010/2011. The data were collected through “walk-through” for the test validation by experts. Their validation will result in accurate tests. In addition, the application of small group testing will result in practical potential positive effects for mathematical problem solving skill. Finally, this study reached good level as shown by the mean score “71”.

Key words: development research, mathematical problem solving

### INTRODUCTION

One of measurement of student’s achievement in order to continue the higher education is the National Examination (UN). The UN question held each of the end of the school year, most of the greater emphasizes are on mastering basic skills is very little about the application of mathematics in the context of daily life, in mathematical reasoning and mathematical problem-solving.

The above problem is the same as research of Sampoerna Foundation (Yuningsih, 2008) which states the distribution of the UN question is still very procedural matter, which is full of calculations. Students are required to do many calculations by applying the formulas without emphasizing problem solving or reasoning. Based on this in the learning of teachers tends to only provide equivalent examination questions and students are trained on how to do the equivalent of UN questions quickly and accurately.

Meanwhile, according to Utordevo (2009) Indonesian students are not trained to convey his ideas in an orderly and clear language. In preparing the matter needs to be assembled questions that do not require long answer, but require students, ideas

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to think mathematically. Through such the questions, students are trained / educated to think independently and decide their own answers without the aid of choices.

As well as proposed Diba, dkk (2009), teachers are accustomed using an approach that emphasizes how to drill or exercises question, so that students are trained procedural matters, the consequences if students are given the questions of other forms that do not fit with the examples given teacher, they can not do about it.

Fact, students do not have adequate problem solving skills, students have difficulty in problems solving. Based on analysis of daily tests only 20% of students able to problem solving correctly (Indriati, dkk; 2009).

The above contradicts the purpose of learning mathematics in Education Unit Level Curriculum, namely:

1. Understanding mathematical concepts, explains the relationship between concepts or algorithms, are flexible, accurate, efficient, and precise, in solving problems.
2. Using the reasoning in the pattern and nature, perform mathematical manipulation in making generalizations, compile the evidence, or explain ideas and mathematical statements.
3. Solve problems that include the ability to understand the problem, designing a mathematical model, complete model and interpret the solutions obtained.
4. Communicate ideas with symbols, tables, diagrams, or other media to clarify the situation or problem.
5. Appreciate the use of mathematics in life, has a curiosity, attention, and interest in studying mathematics, and tenacious attitude and confidence in problem solving (Depdiknas, 2006).

If the goal of learning in the curriculum implemented in each lesson, certainly the students will not difficulties in solving the problems descriptions.

According to Kesumawati (2010) during this, the emphasis is on providing learning mathematics formula, example problems, and exercises regularly. Students are just doing practice questions that directly solved by using formulas and algorithms that have been given so that students are only trained to remember and as mechanics. The consequence is, if they are given a non-routine problems, they do a lot of mistakes. As a result, the ability of Indonesian students'

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mathematical problem solving is still lacking, whereas in mathematics problem solving skills are very important, as proposed by Branca (Nana, 2009: 5) that the ability of the heart of mathematical problem solving, and mathematical problem solving skills can be applied in the field of study other and in everyday life.

According to the Curriculum 2006 (Tim Pustaka Yustisia, 2007: 389), problem solving is a strategic competency that indicated students in understanding, selecting approaches and problem solving strategies, and solve the model to solve the problem. Indicators that show problem-solving, are as follows.

1. Demonstrate understanding of the problem.
2. Organize data and select relevant information in problems solving.
3. Presenting problem mathematically in various forms.
4. Choosing approaches and method problem-solving by exactly.
5. Develop problem solving strategies.
6. Create and interpret mathematical model of a problem.
7. Resolving problems that are not routine.

In this paper, will be developed about the question based on mathematical problem-solving abilities. The indicator that shows the ability of mathematical problem solving in this study are as follows.

1. Demonstrate understanding of issues, including the ability to identify the elements that are known, asked, and adequacy of the required elements.
2. Able to create / develop mathematical models, involves the ability to formulate problems of everyday situations in mathematics.
3. Select and develop a solution strategy, involves the ability to bring various possibilities or alternative way of settlement, the formulas or knowledge which can be used in solving the problem.
4. Able to explain and verify the answers obtained, including the ability to identify calculation errors, errors using the formula, check the compatibility between that have been found with what was asked, and can explain the truth of the answer.

This paper aims to produce (1) questions the mathematical based on indicators of mathematical problem-solving ability junior high school students a valid and practical, (2) knowing about the potential effects.

## RESEARCH METHOD

The method in this research is the development of research methods or research development. This development research to generate questions based on the mathematical description of indicators mathematical problem-solving ability a valid and practical. This research was conducted in two phases: the preliminary stage of preparation and formative evaluation (Tessmer, 1993) includes self evaluation, prototyping (expert reviews and one-to-one and small group), and field test.

### 1. Preliminary Stage

At this stage is to determine the place and subject of research by contacting the school principal and mathematics teacher at school used as study sites, as well as preparations for the study schedule and procedures in collaboration with classroom teachers who will be a place of research.

### 2. Formative Evaluation Phase

#### a. Self Evaluation

At this stage is divided into two namely analysis and design. (1) At this stage of the analysis undertaken is the analysis of curriculum subjects at the junior high school math class IX. (2) Later in the design phase, the researchers designed the lattice and problems of mathematical descriptions based on indicators of mathematical problem solving skills. The process of designing a matter conducted by three characteristics, namely the content, construct, and language. At this stage also conducted an assessment of the matter of mathematical descriptions based on indicators of mathematical problem solving skills by the researcher himself. The result is known as designing the first prototype.

#### b. Prototyping

Expert reviews and one-to-one

Design results in the first prototype was developed on the basis of self evaluation subsequently validated by experts. Experts had reviewed the content, construct, and the language of the prototype. The suggestions of the experts used to revise the description of the problems that developed. In stage one-to-one researchers used three students as a tester, the results are used to revise

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the student comments about the designs that have been made. From the results of revision expert reviews and one-to-one called the second prototype.

### c. Small Group

The second prototype is tested on small groups (a total of six junior high students in grade IX is not the subject of research). The six students have the same characteristics with the characteristics of students who become research subjects. The six students were given about the description and also asked to comment on the matter through a student response sheet. Based on test results and student comments prototype is revised. The revised questions based on suggestions /comments students in small groups and results of analysis on this point is called the third prototype.

### 3. Field Test (Field Test)

The result of revisions to the subjects tested in this research as a field test. The products have been tested in field tests, the product must meet quality criteria. Akker (1999) proposed that three criteria, namely quality: validity, practicality, and potential effects.

### Data Collection Techniques

Based on research methods, the data collection techniques used were (1) documents, (2) Walk Through, (3) test, and (4) interview.

## RESULTS AND DISCUSSION

Development of mathematical problem description based on the indicators of this mathematical problem solving skills to follow the development model that has been described in the previous section, the following stages (1) preparation (2) formative evaluation phase includes self evaluation, prototyping (expert reviews and one-to-one, small group), (3) field test. The result of the development of each stage are as follows.

1. **Preparation Stage Results** obtained include research site is SMPN 9 Palembang, research subjects are students of class IX and teachers of mathematics. Setting schedules and cooperation with teachers of mathematics

### 2. Formative Evaluation Results phase

Results of Formative Evaluation stage is as follows.

(1) Self Evaluation

The results of this phase is a prototype 1, which consists of: (a) the lattice about the description based on mathematical problem-solving abilities indicator on the material three dimensional object, and (b) Problem description and problem-solving based on the indicator description solving capabilities mathematical problem which consists of 8 questions.

## (2) Prototyping

The results of this phase is a prototype of 2 (which has been validated by the expert reviews, and tests on one-to-one) and a prototype 3 (small group testing and validation point about). (a) Expert reviews, validates the matter is qualitatively examined base on content, construct, and language. (b) One-to-one, at this stage been tested on three students individually (one-to-one) with the ability of high, medium, and low. Students are asked to do the problems based on mathematical description indicator mathematical problem-solving ability as much as 8 questions. Then the researchers asked students to provide comments / suggestions on the matter that has been done.

Revised questions based on the validation results of expert reviews and test one-to-one, suggestions, and answer students in one-to-one to produce a prototype 2.

(a) Small Group, at this stage of trying out a prototype 2 which consists of six students SMPN 9 Palembang with three different abilities, namely two students with low ability, two students with the ability to moderate, and two students with high ability. Students are asked to complete all the questions on the answer sheet that has been provided then asked to provide advice and comment on a matter that has been done.

(b) Analysis of test item validity and reliability questions about the item. Item analysis was conducted on students about IX. 2 SMPN 9 Palembang, amounting to 40 students. Calculations using SPSS-17 software for windows. The result of calculation about all the questions the validity of the items declared invalid.

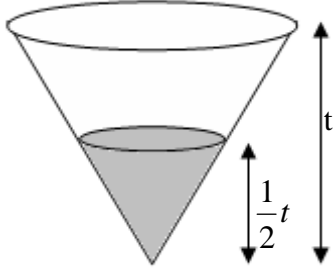
Revised questions based on the results of grain analysis problems, suggestions, and answer students in small groups to produce a prototype 3.

(c) Field test

Prototype 3 (valid and practical) research subjects are tested on a class IX.2 student SMPN 9 Palembang. The questions given to students for 3 hours of lessons. Test was conducted to obtain student learning outcomes. Based on test results obtained by the average student in a classical score is 71 (including good categories).

For development questions need to follow the stages of development put forward Akker for problems that developed measurable quality. One of the stages is the expert validation, testing one-to-one and small group. At this stage the researcher asked the expert to validate the problem and the lattice of question and solving problems by using a sheet of validation. In order for researchers to understand the written comments from the expert, one-to-one and small group, the researcher asked for an explanation verbally.

Based on the results of research in general, students are still hard to do the questions problem solving skills, this happens because students are not familiar with such matters. Here can be seen a few math problems with the development of each indicator of mathematical problem solving abilities for materials three dimensional object.

NO	MATHEMATICAL PROBLEM SOLVING SKILLS INDICATORS	PROBLEM
1	Demonstrate understanding of issues, including the ability to identify the elements that are known, asked for, and adequacy of the required elements.	<p>A cone-shaped place containing water with high water to reach half-height of the cone. If the volume of water is 17.5 liters, calculate the volume of water that can fit these cones!</p>  <p>a. Write down what is known and what was asked!</p> <p>b. In answering this question write down the steps you use!</p>

2	Able to create / develop mathematical models, includes the ability to formulate problems of everyday situations in mathematics.	Pak Aji a craftsman will make a ball of diameter $d$ cm from a long wooden cube ribs $d$ cm. Determine the formula of volume of timber that must be removed. Explain your answer!
3	Select and develop a solution strategy, involves the ability to bring various possibilities or alternative way of settlement, the formulas or knowledge which can be used in solving the problem.	If the blanket cylinders same broad area of square diagonal $\sqrt{5}$ cm long. Explain how to determine the extent of the base of the tube?
4	Able to explain and verify the answers obtained, including the ability to identify calculation errors, errors using the formula, check the compatibility between that have been found with what was asked, and can explain the truth of the answer.	Aji, Akbar, and Didit has 3 solid ball of candle ,which respectively have a radius of 5 cm, 4 cm and 3 cm. They plan to merge the three b all candle into a big solid ball. Once calculated, Aji said the radius of the solid ball that is 6 cm, 12 cm Akbar states, and Didier claim 9 cm. Show calculation of who is right and give explanations answer!

## CONCLUSIONS AND SUGGESTIONS

This research produced a mathematical description about the product development based on indicators mathematical problem-solving ability junior high school students. Based on the results obtained the following conclusion.

1. Problem description that was developed designated valid and practical. Questions generated as much as 8 concerning which consists of 4 indicators of mathematical problem-solving ability of each indicator there are two questions of every description are developed.
2. Problem description of the system has a potential effect, as seen from the description about the test results based on students' mathematical problem solving ability with an average rating of 71 (including both categories).

Based on the results of the study, the researchers recommend:

1. For teachers to increase their knowledge of the problems solving mathematical problems so that teachers can familiarize students with the problems solving mathematical problems.



2. For other researchers, the matter can be used as input for more in-depth review of the questions based on the indicator description mathematical problem-solving abilities.

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