DEVELOPING MODEL ELICITING ACTIVITIES (MEAs) STUDENT WORKSHEET ON THE TOPIC OF THE SURFACEAREA OF THE CUBE AND CUBOID FOR THE EIGHT GRADERS

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Abstract

The surface area of cube and cuboid is very important because it is highly related and frequently applied in daily life. Studies have proven that in working on material cubes and cuboids, students often make mistakes, especially in solving problems related to the surface area of cubes and cuboids. Model Eliciting Activities (MEAs) are seen as an important way to develop students' problem-solving abilities. In order to provide an effective learning process for the students, teachers are expected to develop teaching materials as a learning source. That is why researchers need to develop an effective Model Eliciting Activities (MEAs) student worksheet. Hence, the purpose of this research is to produce a valid and practical Model Eliciting Activities Student Worksheet. The method used in this research is the design research type development study. The research subjects were 35 students of grade VIII in SMP Negeri 18 Palembang. The study resulted several characteristics of model eliciting activities which are including (1) MEas student worksheet for the surface of cubes and cuboid are developed based on the steps and principles of MEAs learning methods; (2)each developed worksheet consists of three issues; (3) the developed student worksheet was associated and / or connected with problem solving ability indicators. Model Eliciting Activities student worksheet can be used to develop mathematical problem solving ability.

Keywords: Model Eliciting Activities, Worksheet, Design research type development study, Cube and Cuboid.

INTRODUCTION

Pittalis, Mousoulides, & Christou (2010) stated that geometry and three-dimensional (3D) thinking is connected to every strand in the mathematics curriculum and to a multitude of situations in real life. A number of researchers investigated students understanding of three dimensional rectangular arrays (3-D) of cubes, using interviews or test. Particularly, Ben-Chaim et al indicated four types of errors that students in grade 5-8 made .Geometry and three-dimensional (3D) are very important because it is being applied in everyday life, but in the application of three-dimensional geometry in learning, students still often did some error, especially in solving problems.

Moreover, Wessels (2014) stated that Model Eliciting Activities is an important way to develop students' skills in problem solving. In a study with 16 teachers in Taiwan stated that applying the model eliciting activities could lead to a positive attitude and improve students' problem-solving abilities. In addition, government regulation No. 19 2005 Pasal 20 suggests that teachers are expected to be able to develop teaching materials as a

source of learning, which is the part of the lesson plan (RPP). So that, teachers become helpful in getting competence (Depdiknas, 2006).

Seeing the problems that students often still do some error in the material cubes and cuboid, and considering the relevant government regulations, the researchers decided to conduct a study entitled "Developing Model Eliciting Activities (MEAs) Student Worksheet for Cube and Cuboid Surface Area of Grade VIII". The research question in this study is *how can we create and develop a more valid and practical characteristics of Model Eliciting Activities Student Worksheet?*

THEORETICAL FRAMEWORK

Student Worksheet

According to Prastowo (2014), student worksheet is a printed instructional materials in the form of sheets of paper which contains material, summaries, and guide the implementation of learning.

Model Eliciting Activities (MEAs)

Hamilton (2008) defined model eliciting activities (MEAs) as a learning model that directs students in real-world situations through a working team consisting of 3-4 small people to solve real world problems. Therefore, MEAs are activities that encourage students to create models to resolve issues through small learning teams consisting of 3-4 people. Furthermore, Less, Hoover, Kelly & Post (2000) studied that there are two reasons why MEAs should be developed and well-applied: (1) learners are given the opportunity through the modeling of complex mathematical problems to consolidate existing mathematical knowledge and build new knowledge; (2) teachers are given the opportunity to study the mathematical thinking of students.

According to Lesh & Doerr (2003a), principles of Model eliciting activities are as follows: 1) Model Construction; 2) Reality; 3) Self – Assessment; 4) Model Documentation; 5) Construct Share-Ability and Re-Usability; 6) Effective Prototype. Then, the following are four basic steps in the modeling activities (Lesh & Doerr, 2003a):

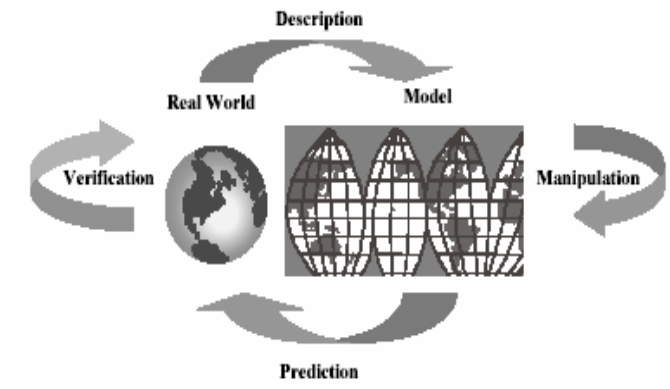


Figure 1: The basic step cycle of modeling

1. *Description*
2. *Manipulation* of the model in order to generate predictions or actions related to the original problem solving situation.
3. *Translation* (or prediction)
4. *Verification* concerning the usefulness of actions and predictions.

The topic related to the surface area of cube and cuboid Indonesian curriculum is described in the table below.

Table 1: The topic of the surface area of cube and cuboid Indonesian curriculum

Competency Standards	Basic Competencies	Indicators
5. Understand the properties of cubes, cuboid, prism, pyramid, and parts, as well as determine the size	5.3 Calculate the surface area and volume of cubes, cuboid, prism and pyramid.	• Calculate the surface area of a cube that relate to everyday life. • Calculate the surface area of a cuboid that relate to everyday life.

METHOD

This research aims to produce the characteristic Model Eliciting Activities student's worksheet a valid and practical. The method in this research is the development of research methods or development research of a type of formative research. Stages involved in this research are as follows (Zulkardi, 2006):

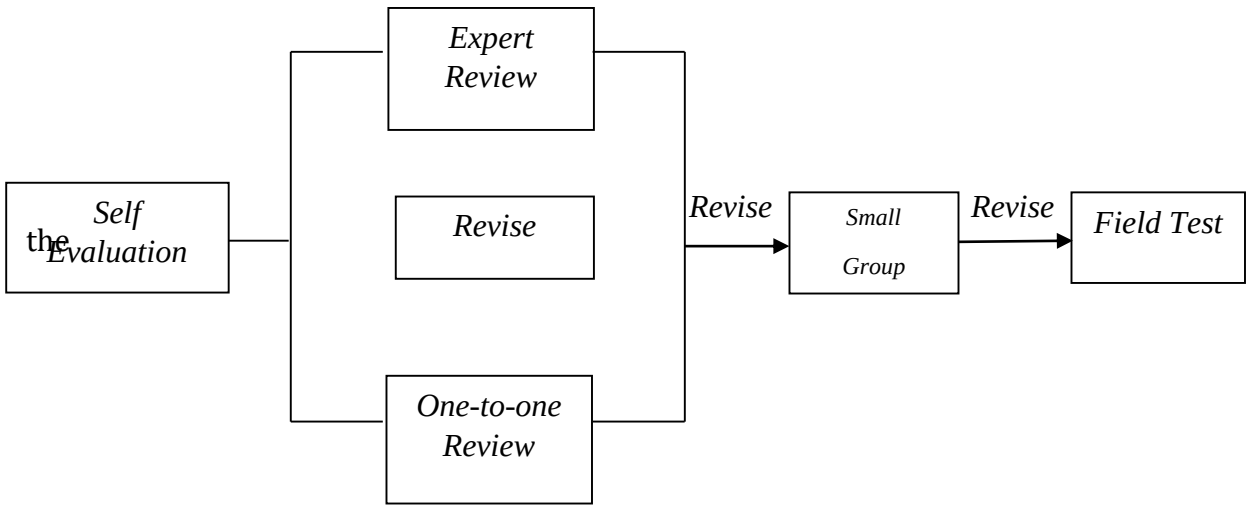


Figure 2: Stage of Development Research

The technique of data Collection that is employed in this study is observation. According to Sudijono (2011), observation is a way to collect information materials done by conducting a systematic observation and recording of phenomena that are being targeted for observation. The observations are made during the learning process by using observation sheet developed by the researchers. In this study, researchers assisted by two observers were in charge of observing the activity of students during the learning

process. The observation is used to determine the practicality of the student Worksheet that has been developed.

Data on students' learning activities acquired during the learning process was takes place by using the observation sheet. Student's activity observed during the learning process through comprehensive discussion to complete the worksheets. Student Worksheet (LKS) which had completed scores were analyzed based on completion of worksheets that have been compiled by researchers which were then converted in the following table:

Table 2: Assessment Criteria Student Worksheet

Score (%)	Criteria
91-100	Very Good
81-90	Good
71-80	Enough
<70	Less

(Modification Nasoetion, 2007)

RESULT AND DISCUSSION

Self Evaluation:
Results of self evaluation stage prototype 1. Prototype 1 was validated by experts and tested on one-to-one students.

Expert Review:
Examples of expert's comments:

Kesimpulan: Secara umum masalah yang ada pada LKS dan Tes sudah baik dan cocok untuk mengembangkan kemampuan pemecahan masalah siswa. Akan tetapi, dari segi kebahasaan dan redaksi masalah/soal masih perlu perbaikan yang serius.

Padang, Maret 2015

Validator

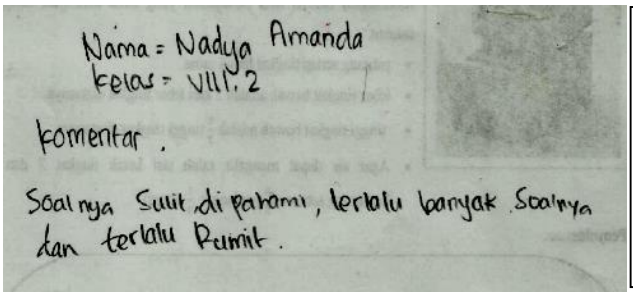
Prof. Dr. Ahmad Fauzan, M.Pd., M.Sc.

NIP. 19660430 199001 1 001

Conclusion: in general the problems that exist in the worksheet and tests have been good and suitable to develop students' problem-solving abilities, but in terms of linguistic and editorial, issues/problems still further significant improvement needs to be done.

Figure 3: Prof. Dr. Ahmad Fauzan's comments

One-to-one:
Examples of one-to-one's comments:

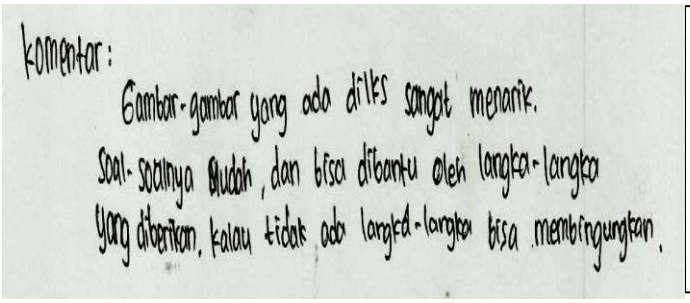


Comment: The questions were difficult to understand and the number of them are too many.

Figure 4: One-to-one's comment

Resulted comments from the experts and one-to-one student were used as material for revision. Prototype 1 revised named as prototype 2, then prototype 2 tested on small groups students.

Small Group:
Example of small group's comment:



Comment: Images used on the student worksheet are very interesting, the questions were easy and can be resolved using the given steps. If the steps were not given, the questions can be confusing and hard to be resolved.

Figure 5: Small group's comment

Resulted small group's comment was used for material revisions which later named as a result of the revision of the prototype three.

Field Test:
The third prototypeis an instrument that has a valid and practical, and tested to the student's field test. By using Model Eliciting Activities (MEAs) student worksheet for cubes and cuboids surface area, researchers conducted observations whose results can be seen as followed:

Table 3: Result of observations during the learning

NO.	ASPECT	(%)
1.	***Model Construction***	77,5
2.	***Self Assessment***	85
3.	***Model Documentation***	85
4.	***Construct Share Ability and Re-Usability***	66,7
	Average	78,5

In the *Model Construction* aspect shows that the students are able to identify the elements that are important, while the students' understanding of the problem is still lacking because students were often wrong at interpreting in everyday language into the language of mathematics, so that students experience an error in building the model. In terms of *Self Assessment*, the aspect has been able to test the solution that they have got, but still have students who have not been able to assess or determine that they get solutions including true or false. It can be observed by different opinions given by the student in the discussion. Some students were able to come up with correct answers, but in their calculation they still often experienced certain errors. In the *Model Documentation* aspect, the student still cannot clearly describe their thinking processes in constructing the model, it was observed that they could build the model, but there was no initial step is to convert the problem into the form of a variable. In the *Construct Share Ability and Re-Usability* aspect, students were able to present a solution that they get, but they are still lack in discussions with other groups based on the arguments and solutions. Thus, from the observation of the four aspects MEAs learning reached 78.5 or on average category.

CONCLUSION

Student Worksheet (Prototype) is proven to be valid, practical and effective. Student Worksheet can be said to be valid because it has been through a validation process by experts based on content, construction, and language. Student Worksheet is considered practical as seen from the results of tests on a small group, where students can well-completed the Model Eliciting Activities (MEAs) Student Worksheet. Student Worksheet can be said to be effective based on the observation of the learning activities during field tests. Characteristics of Model Eliciting Activities are: (1) Model Eliciting Activities student worksheets for cubes and cuboid surface area are developed in accordance with the steps and principles of Model Eliciting Activities (MEAs) learning methods (i.e. description , manipulation, prediction, verification and real world, model construction, model documentation, self-assessment, construct share ability and re-usability, effective prototype); (2) Worksheet was developed and each one consists of three issues: Issue 1 used given steps to address the problem along with guidance in every step of charging, issue 2 used given steps to address the problem, but without guidance in the charging step, and issue 3 did not use given step or guidance to address the problem; (3) The developed student worksheet was associated and/or connected with problem solving ability indicators.

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