Validity Of Mathematical Learning Material Based On Model Eliciting Activities (MEAS) Approach To Improve Mathematical Creative Thinking Skill Of Students

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Abstract. This paper discusses the validity of mathematical learning material based on MEAS approach in improving mathematical creative thinking skills of high school students. This learning material was validated by experts from mathematics, language and educational technology backgrounds. The conclusion that the learning material was categorized valid and can improve students' creative thinking skills.

Introduction
Mathematical creative thinking is one of the higher order thinking skills (HOTS) that is important to be developed in the 21st century. Especially during the 4.0 industrial revolution as it is today. This ability is considered important that it is called one of the most important assets of a nation [1].

Creative thinking is an ability to solve problems in various ways or in new ways. Students' creative thinking ability is the ability of students to produce many possible solutions and ways to solve problems [2]. Creative thinking interpreted as the ability to create something new, or the ability to place and combine a number of different objects derived from human thought that is understandable, efficient, and innovative with a variety of factors that can influence [3].

However, students' creative thinking abilities have not yet developed maximally. Some of the causes are the use of learning tools that have not been optimal in maximizing students' creative thinking abilities. Learning tools used tend to contain material summaries, sample questions, and exercises, there are no structured steps in the packaging of materials [4,5].

From many learning approach, which can develop students' creative thinking abilities is Model Eliciting Activities (MEAs). MEAs is an approach that develops students' ability to build a model with collaboration in groups [6].

In order for the MEAs approach to run optimally, we need a learning tool that supports the implementation of the phases in the MEAs approach. Learning with the MEAs approach in class will run well if the teacher prepares a Learning Implementation Plan (RPP). The activities in the RPP are supported by the Student Worksheet (LKPD) [7].

In this study, the type of LKPD developed is LKPD which helps students find a concept and LKPD which helps students implement and integrate various concepts that have been discovered. LKPD which helps students find a concept contains what must be done by students, including doing, observing and analyzing. Therefore, the LKPD designer needs to formulate steps that students must take. Then analytical questions are given which help students to relate the phenomena they observe to the concepts they will build in their minds. Whereas LKPD which helps students implement and integrate
various concepts means that after students have succeeded in finding concepts, students can be trained to apply the concepts they have learned in their daily lives. Teacher giving students assignments to be discussed, then asking them to practice giving freedom of opinion and responsibility.

This study describes a mathematical learning tool based on a valid MEAS approach in improving students’ creative thinking abilities. Validity was obtained based on the results of the analysis of the learning tool questionnaire (RPP and LKPD). This validity was assessed by 5 experts.

**Research Methods**
The Plomp development model consists of three stages, namely preliminary research, the development or prototyping phase, and the assessment phase [9]. Meanwhile, the validity and quality of the results of the developed learning tools refers to the criteria proposed by Nieveen [10].

Validation on this device consists of content validity and construct validity. Validity came from validation sheet and discussions with lecturers. The validity results of this device were obtained in the prototype development phase (development or prototyping phase). The validity instrument is in the form of a questionnaire assessed by 5 experts, namely 3 mathematics lecturers, 1 language lecturer, and 1 education technology lecturer. While the validation data consists of quantitative and qualitative data.

**Result of Literature Review**

1.1. **Overview about MEAS**
Model Eliciting Activities was created by mathematics educators in the United States and Australia. The goal is to increase student activity in developing mathematical models of a real problem [12]. Students work in small groups of 3-5 students. Students create model the problem, test and revise model, find solutions from the model, re-test the solution, and present it to other groups [13].

MEAS approval is one that facilitates students who are more active in solving problems. The problem is given by the teacher. Where the problem is a real problem in the daily life of students. After students solve problems, students develop mathematical problem solving models, then students try to solve model. In the group, students discuss the best mathematical models and model solutions. The final step is students present it to the class and other groups assess.

1.2. **The Implementation of MEAs in Learning**
MEAs implemented in several steps. The first is the teacher reads articles or news in real life for students. Then, the teacher creates a mathematical question. Next, students answer these questions to determine whether students answer the problem. After students understand the problem, students to create a problem solving model. Then students look for solutions to problem solving and present their models in front of the class [12]

In this approach, there are 6 principles [14]. Detail activities of teacher and students during can be seen in below:
Table 1. Steps of Learning Activities of Model Eliciting Activities Approach

| Step                      | Teachers’ Activity                          | Students’ Activity                        |
|---------------------------|---------------------------------------------|-------------------------------------------|
| Step 1. Define of problems| Gives a real problem                       | Students observe, understand and define the problems |
| Step 2. Description of problems| Give are problems about real problem           | Creating a basic understanding of the problem based on initial knowledge |
| Step 3. Manipulation      | Guide students in modeling problems         | Designing mathematical models based on problem description |
| Step 4. Translating       | Lead students to solve problems             | Solve mathematical models based on student knowledge |
| Step 5. Verifying and Predicting | Ask students to reopen answers to problems that have no mistakes | Check their work one by one |
| Step 6. Presentation      | Listens to the student's presentation       | Present of the work they discussed        |

1.3. Relationship between Model Eliciting Activities and Creative Thinking Skills

Relationship between MEAs and creative thinking skills students is creativity of students in learning is the main thing of MEAs. Creativity is the most important thing in this approach, especially in the aim of learning mathematics. Creative student always have good ideas or are new ideas in solving problems.

This can be interpreted that the mathematical creative thinking skills is the skills to produced or developed something new that is something unusual that differs from ideas produced by students by utilizing concepts previously obtained, where the creative thinking ability of students is characterized by students to think fluently, flexible, has original ideas, and can elaborate well.

Discuss

Validation data consists of quantitative and qualitative data. Quantitative data are scores obtained from the validator using a scale that includes aspects of practicality and module effectiveness. Then, qualitative data sources, namely in the form of suggestions, responses, and criticisms are given written and oral [11]. Validation data both quantitative and qualitative are used as consideration for revising for the improvement of the module (prototype 2). In addition, to get the maximum module development results, it is necessary to do an assessment first. The assessment was obtained from interviews and quantitative assessments. The assessment component includes the aspects MEAs, instruments, observed data, and respondents.

Aspects of the lesson plan validated by experts:
Table 2. RPP Validation by Experts

| Number | Rated aspect                  | Method of collecting data | Instrument | Purpose                                      |
|--------|-------------------------------|---------------------------|------------|----------------------------------------------|
| 1      | Components of RPP            |                           |            | To find out the content validity and construct validity of RPP based on MEAs |
| 2      | Identity of RPP              |                           |            |                                              |
| 3      | Indicators                   |                           |            |                                              |
| 4      | Purpose Learning             |                           |            |                                              |
| 5      | Teaching materials           |                           |            |                                              |
| 6      | Model / approach / methods   | Provide prototype 1 validated. | Validation sheet and revision list |                                              |
| 7      | Learning Activities          |                           |            |                                              |
| 8      | Learning Resources           |                           |            |                                              |
| 9      | Assessment                   |                           |            |                                              |
| 10     | Writing and language procedures |                           |            |                                              |
| 11     | Benefits of RPP              |                           |            |                                              |

The validation aspects of LKPD are presentation, material and content, language and appearance. Aspects of LKPD validated by experts as follows:

Table 3. LKPD Validation by Experts

| Number | Rated aspect                  | Method of collecting data | Instrument | Purpose                                      |
|--------|-------------------------------|---------------------------|------------|----------------------------------------------|
| 1      | Didactic or presentation aspects |                           |            | to find out the validity of LKPD based on MEAs that has been designed, obtain information about the accuracy of all aspects of LKPD development |
| 2      | Material and content aspects  | Provide prototype 1 validated. | Validation sheet and revision list |                                              |
| 3      | Aspects of language           |                           |            |                                              |
| 4      | Aspect of graphics or appearance |                           |            |                                              |

Based on the analysis of validation results by 3 mathematicians, the percentage of validity obtained for the RPP is 91.41. This means that in overall RPP categorized as very valid criteria. Some aspects of the validity of learning tools assessed by mathematicians include: subject identity, core competencies, basic competencies, formulation of learning indicators, objectives, selection of learning materials, strategies, resources, instructional media, steps of activities learning, assessment, language and writing, and the benefits of lesson plans.
| Aspects                                      | Score of Validators | Average | Validity | Percent | Criteria of Validity |
|---------------------------------------------|---------------------|---------|----------|---------|----------------------|
|                                             | 1  2  3             |         |          |         |                      |
| Identity of lesson                          | 4  4  4             | 4,00    | 4,00     | 100,00  | Very valid           |
| Core Competencies (KI) and Basic Competencies (KD) | 4  4  4             | 4,00    | 4,00     | 100,00  | Very valid           |
| Formulation of Learning Indicators          | 3  4  4             | 3,67    | 3,67     | 91,67   |                      |
| Formulation of Learning Objectives          | 3  3  4  4          | 3,33    | 3,67     | 91,67   | Very valid           |
|                                            | 4  4  4  4          | 4,00    |          |         |                      |
|                                            | 4  4  4  4          | 4,00    |          |         |                      |
| Selection of Learning Materials             | 4  3  4  4          | 3,67    | 3,93     | 98,33   | Very valid           |
|                                            | 4  4  4  4          | 4,00    |          |         |                      |
|                                            | 4  4  4  4          | 4,00    |          |         |                      |
| Selection of Learning Strategies            | 4  4  4  4          | 4,00    | 4,00     | 100,00  | Very valid           |
| Selection of Learning Resources             | 4  4  4  3          | 3,67    | 3,78     | 94,44   | Very valid           |
|                                            | 4  3  4  4          | 3,67    |          |         |                      |
|                                            | 4  4  4  4          | 4,00    |          |         |                      |
| Learning Media Selection                    | 3  3  4  4          | 3,33    | 3,50     | 87,50   | Very valid           |
|                                            | 3  3  4  4          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
| Steps of Learning Activities                | 3  3  4  3          | 3,33    | 3,33     | 83,33   | Enough               |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
| Assessment                                  | 3  3  4  3          | 3,33    | 3,33     | 83,33   | Enough               |
| Language and writing                        | 3  3  4  3          | 3,33    | 3,33     | 83,33   | Enough               |
| Benefits of RPP                             | 3  3  4  3          | 3,33    | 3,33     | 83,33   | Enough               |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
|                                            | 3  3  4  3          | 3,33    |          |         |                      |
| Average                                     | 91,41               |         |          |         | Very valid           |
Table 5. Validation Results by Language Experts

| Aspects                                                                 | Score | Average | Percentage | Criteria of Validity |
|------------------------------------------------------------------------|-------|---------|------------|----------------------|
| The type of writing is easy to read and precise                        | 4     | 4,00    | 100,00     | Very valid           |
| The language used is communicative and adjusted to the level of understanding of students | 3     | 3,00    | 75,00      | Enough               |
| LKPD uses language that is clear and easy to understand so it does not lead to different interpretations | 3     | 3,00    | 75,00      | Enough               |
| The sentences used have punctuation marks                              | 4     | 4,00    | 100,00     | Very valid           |
| The sentences used are in accordance with the rules of the language    | 3     | 3,00    | 75,00      | Enough               |
| The term used is appropriate                                           | 3     | 3,00    | 75,00      | Enough               |
| How to write terms, symbols, and mathematical equations are appropriate| 4     | 4,00    | 100,00     | Very valid           |
| **Average**                                                            |       | 85,71   |            | Very valid           |

Table 6. Validation Results by Educational Technology Experts

| Aspects                                                                 | Score of Validators | Percentage | Criteria of Validity |
|------------------------------------------------------------------------|---------------------|------------|----------------------|
| The front cover design is made in such a way that the color combination is more attractive and represents the contents of the LKPD | 3                    | 75,00      | Enough               |
| The letters used in LKPD are quite interesting and easy to read        | 4                    | 100,00     | Very valid           |
| The problem is clarified with an interesting, relevant and appropriate picture of the problem | 4                    | 100,00     | Very valid           |
| The layout and appropriateness of the text and image sizes are correct | 3                    | 75,00      | Enough               |
| Section titles and parts that need emphasis are in bold and attractive colors | 3                    | 75,00      | Enough               |
| The use of colors in LKPD according to need                            | 3                    | 75,00      | Enough               |
| The overall LKPD display design is attractive                          | 3                    | 75,00      | Very valid           |
| **Average**                                                            | 3                   | 82,14      |                 |

Based on the categories obtained by each of these aspects, the overall MEAs-based LKPD obtained an average percentage of 93.44 with very valid criteria. This shows that according to the MEAs-based LKPD experts this is already very valid and can be used in the learning process.

Based on the analysis of the results of the study, it was concluded that the learning tools based on the MEAs approach produced in this study were valid. The RPP based on MEAs developed is valid both in terms of content (product conformity with 2013 curriculum and material) and construct.
(conformity with the elements and principles of MEAs and consistency in development). The LKPD-based MEAs that were developed were valid both in terms of content (product compatibility with 2013 curriculum and material) and constructs (conformity with the elements and principles of the MEAs).

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