# THE DEVELOPMENT OF MATHEMATIC WORKSHEET BASED ON CRITICAL ACTIVITIES FOR YUNIOR HIGH SCHOOL STUDENTS

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## ABSTRACT

This research aims to develop the mathematic worksheet. This research focuses on: (1) the development of the mathematic worksheet based on critical activities ; (2) the difference between the critical thinking skills of students before and after using the mathematic worksheet based on critical activities; (3) the attitude of students towards learning by using the mathematic work sheet based on critical activities. This research uses *ADDIE* model which consists of 5 steps: *Analysis, Design, Development, Implementation and Evaluation*. The instrument used in this study were: (1) validation sheet and questionnaire test on a limited scale; (2) pretest and posttest question; (3) the scale of the students' attitude. The results of this study are as follows: (1) based on the validation result of the experts' test which consists of the teaching-learning aspect, the substance of the material, linguistic and graphic, the average score of 4,25 is obtained, which is in good category, while the validation result of the limited scale test which consists of the ease usage aspect, dispaly and features, the average score of 4,34 is obtained, which is in good category, so that the mathematic worksheet are good and the product is ready to be used in schools; (2) there are differences in students' critical thinking skills before and after using the mathematic worksheet based on critical activities; (3) based on the attitude scale data analysis, it is found that most students show positive attitude towards learning by using the mathematic worksheets based on critical activities.

**Keyword:** mathematics worksheet; critical activities.

## I. INTRODUCTION

Teaching materials is an important part of the learning process. Teaching materials are materials or subject matter systematically arranged, used by teachers and learners in the learning process. (Pannen in Prastowo, 2011).

Teaching materials can be either written or oral material. One of the teaching materials that can be developed in the teaching -learning are students' worksheet. There are many reasons for developing a students' worksheet, those are the students' worksheet generally is only train students to answer the questions or there is only a matter clusters in the students' worksheet, and provides a summary of the material so it does not require students to find their own concepts learned through process skills activities, as well as the availability of teaching materials appropriate to the curriculum.

Students' worksheet is one alternative teaching material appropriate for students because the student activity sheet helps students to add information about the concepts is learned through systematic learning activities (Suyitno, 1997).

In general guide development of teaching materials (Department of Education, 2004), students' worksheet are sheets contains a task that have to be done by learners. Students' worksheet can be a guide for the development of cognitive practice and guidance for the development of all aspects of learning in the form of guides experiments and demonstration experiments (Trianto , 2011)

Therefore teachers need to develop students' worksheet that can develop students' thinking skills, including critical thinking skills.

Critical thinking is a process of systematic, organized, which allows students to evaluate evidence, assumptions, language and logic underlying statements of others in order to achieve a profound understanding (Johnson, 2012).

Critical thinking is reasoned and reflective thinking with an emphasis on making decisions about what has to be believed or be done. Therefore, indicators of critical thinking can be derived from students' critical activity (Ennis in Mulyana, 2008)

In this study to develop teaching materials in the form of a mathematic worksheets based on critical activities using *ADDIE Model* (*Analysis, Design, Development, Implementation, and Evaluation*).

## II. RESEARCH METHOD

The method is used in this research is a method of research and development (*R & D*). In this study, the mathematic worksheets based on critical activities developed by using the *ADDIE* Model *(Analysis, Design, Development Implementation, Evaluations).*

In the *analysis* phase the researcher does needs analysis, curriculum analysis, and analysis of student characteristics, in *design* phase was obtained content design, in *development* phase, preparation of the the mathematic worksheets and expert testing, testing on a limited scale and product revision, the *implementation* phase of the teaching-learning process does to determine the effectiveness of mathematic worksheets based on critical activities, and the *evaluation* phase includes the implementation of the results of the data analysis and final revision if any, so it was obtained mathematic worksheets based on critical activities.

The data was resulted from this study is quantitative data and qualitative data. Quantitative data in the form of: 1) the percentage of the results of expert validation, test and attitude scale limited scale, 2) value test students' critical thinking skills obtained from the written test or essay in narrative form by 5 questions. Descriptive

qualitative data in the form of mathematic worksheets based on critical activities and students' attitudes towards the mathematic worksheets based on critical activities.

## III. THE RESULT OF DEVELOPMENT AND DISCUSSION

### A. Overview Development of Mathematic Worksheets Based on Critical Activities Using *ADDIE* Model

The analysis phase includes analysis of curriculum, analysis of student characteristics and analysis of teaching materials

Curriculum analysis was done by the literature study include: analysis of the subject matter, competence and basic competences. Characteristic of student analysis is to identify the characteristics of students who will use the mathematic worksheets based on critical activities that is student. Analysis of teaching materials is done with analysis teaching material whatever is used in studying mathematic at school which will be an object of research.

At the design phase, the researcher did design of outline the contents of mathematic worksheets based on critical activities, which consists of four mathematic worksheets such as the surface area of cubes and blocks, cubes and blocks volume, surface area of the prism and pyramid, prism and pyramid volume.

At this stage of development, there are three activities performed after the preparation of mathematic worksheets based on critical activities that test expert, limited-scale testing and product revision.

Based on the results of the validation by expert lecturers and teachers of mathematics and the trial is limited by the 10 eighth graders are at a good qualification. So that the actual product is ready to be used for activities in the field of learning / not revised. Results of analysis of expert validation and limited test presented in Table 1 and 2.

**Tabel 1. The Result of Questionnaire Validation by Experts**

| No | Aspect and Indicator | Experts | | | | Score |
|---|---|---|---|---|---|---|
| | | E1 | E2 | E3 | E 4 | |
| **Teaching - Learning** | | | | | | |
| 1 | Suitability of the material with Competency Standards and Basic Competence | 4 | 4 | 5 | 5 | 18 |
| 2 | Suitability of the material with needs of students | 4 | 3 | 5 | 4 | 16 |
| 3 | Relevance between evaluations and learning objectives | 4 | 4 | 5 | 5 | 18 |
| **Substance of Matter** | | | | | | |
| 4 | Material truth in theory and concepts | 4 | 5 | 4 | 5 | 18 |
| 5 | Correct use of the term appropriate scientific field | 3 | 4 | 4 | 5 | 16 |
| 6 | depth of the material | 3 | 5 | 4 | 5 | 17 |
| 7 | Conformity with the order of the material the students' ability level | 3 | 5 | 5 | 4 | 17 |
| **Linguistic** | | | | | | |
| 8 | Using a clear sentence structure | 3 | 5 | 5 | 5 | 18 |
| 9 | Clarity of information (materials, symbols) | 3 | 5 | 5 | 5 | 18 |
| 10 | Language in accordance with the rules of Indonesian | 3 | 4 | 4 | 4 | 15 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | Use language effectively and efficiently | 3 | 4 | 4 | 4 | 15 |
| **Graphic** | | | | | | |
| 12 | Using block letters and do not use the Latin alphabet or Roman | 4 | 4 | 5 | 5 | 18 |
| 13 | Composition and size and layout (titles, illustrations, etc.) proportional, balanced and in tune with the layout of the content (corresponding pattern) | 4 | 4 | 5 | 5 | 18 |
| 14 | Content layout consistency | 4 | 4 | 5 | 4 | 17 |
| 15 | Harmony content layout | 4 | 4 | 4 | 4 | 16 |
| **Number** | | | | | | 255 |
| **Averange** | | | | | | 4.25 |

category: 5 = very good, 4 = good , 3 = enough, 2 = not good, 1 = is not very good

Based in table 1 shows that based on the validation result of the experts' test which consists of the teaching learning aspect, the substance of the material, linguistic and graphic, the average score of 4,25 is obtained, which is in good category

**Table 2. The Result of Questionnaire Limited Trial**

| No | Aspect and Indicator | Student | | | | | | | | | | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | |
| | **Ease of use** | | | | | | | | | | | |
| 1 | Mathematical problems and solutions presented in mathematic worksheets | 4 | 4 | 4 | 5 | 3 | 5 | 5 | 5 | 5 | 5 | 45 |
| 2 | Mathematical concepts presented in mathematics worksheets | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 41 |
| | **Display** | | | | | | | | | | | |
| 3 | Physical appearance | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 44 |
| 4 | Writing and images | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 45 |
| | **Features** | | | | | | | | | | | |
| 5 | Images contained in easy to understand | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 43 |
| 6 | The images in the "find out" easily understood | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 38 |
| 7 | Concept discovery steps | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 48 |
| | **Number** | | | | | | | | | | | 304 |
| | **Averange** | | | | | | | | | | | 4,34 |

category: 5 = very good, 4 = good , 3 = enough, 2 = not good, 1 = is not very good

Based in table 2 shows that validation result of the limited scale test which consists of the ease usage aspect, dispaly and features, the average score of 4,34 is obtained, which is in good category, so that the mathematic worksheets based on critical activities are good and the product is ready to be used in schools

In the implementation phase, the learning process is carried out to determine the effectiveness of student mathematic worksheets based on critical activities who becomes the object of this study was eighth grade students of SMP Negeri 17 in Bandung.

In this research, meeting six times that at first meeting conducted a pretest, the second meeting up with the fifth meeting of the teaching-learning process is carried out using mathematic worksheets based on critical activities, whereas the sixth meeting did post test. This study was conducted on May 3, 2013 until May 21, 2013.

At this stage of the evaluation, revision of mathematic worksheets based on observations during the teaching- learning process. It can be seen from the attitude scale questionnaire given at the end of the teaching-learning process using mathematics worksheets. Revision of the results obtained for the final product in the form of mathematic worksheets based on critical activities for junior high school students of class VIII semester

## B. Critical Thinking Ability Differences Before and After Using Mathematic Worksheets Based on Critical Activities.

Descriptive data about students' critical thinking ability before and after use mathematic worksheet based on critical activity can be seen in Table 3

**Tabel 3 . Descriptive Data of Students' Critical Thinking Ability**

| Using Mathematic Worksheets Based on Critical Activities. | | Statistic |
|---|---|---|
| Before | Mean | 30,3871 |
| | Median | 30,0000 |
| | Variance | 79,712 |
| | Std. Deviation | 8,92815 |
| | Minimum | 10,00 |
| | Maximum | 50,00 |
| | Range | 40,00 |
| After | Mean | 78,8065 |
| | Median | 80,0000 |
| | Variance | 94,828 |
| | Std. Deviation | 9,73796 |
| | Minimum | 60,00 |
| | Maximum | 100,00 |
| | Range | 40,00 |

Furthermore, to see whether there is difference in students' critical thinking skills before and after use mathematic worksheets based on critical activities, the mean difference in the two tests used in this case paired sample t test. The hypothesis is:

$H_0$ = There were no differences between the students' critical thinking skills before and after using mathematic worksheets based on critical activities

$H_1$ = There are differences between the students' critical thinking skills before and after using mathematic worksheets based on critical activities

Calculation results can be seen in Table 4

**Tabel 4. Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | After - Before | 48,4194 | 10,3755 | 1,8635 | 44,6136 | 52,2251 | 25,983 | 30 | 0,000 |

Determination of hypotheses based on: if the Sig > 0.05 then $H_0$ is accepted and if the Sig < 0.05 then $H_0$ is rejected.

Based on Table 4 shows that the Sig is 0.000. Because the Sig < 0.05, then $H_0$ is rejected or it can be said that the students' critical thinking ability before and after using mathematic worksheets based on critical activities differ significantly. So the use of mathematic worksheets based on critical activities highly effective in improving students' critical thinking ability

**C. Student Attitudes Toward Mathematic Worksheets Based on Critical Activities**.

Based on the results of attitude scale data analysis showed that students' attitudes are positive towards mathematic worksheets based on critical activities.

From the results of the students' attitude scores of 3,68 and 2,5 indicates a neutral attitude that students positive attitudes toward mathematic worksheets based on critical activities on the material flat side up space

## IV. CONCLUSION

Based on the results of research on the development of teaching materials such as mathematic worksheet based on critical activities, it is concluded as follows:

1. based on the validation result of the experts' test which consists of the learning aspect, the substance of the material, linguistic and graphic, the average score of 4,25 is obtained, which is in good category, while the validation result of the limited scale test which consists of the ease usage aspect, look and features, the average score of 4,34 is obtained, which is in good category, so that the mathematic worksheet are good and the product is ready to be used in schools;
2. there are differences in students' critical thinking skills before and after using the mathematic worksheet based on critical activities;
3. based on the attitude scale data analysis, it is found that most students show positive attitude towards learning by using the mathematic worksheets based on critical activities.

Advice can be given are: the development of student activity sheet can cover a wider material or on other subjects as well as more creative in making math student activity sheet.

## V. BIBLIOGRAPHI

Ministry of Education. 2004. *General Guidelines for Selection and Use of Instructional Materials.* Jakarta : Directorate General of Basic Education in Secondary

Johnson, Elaine B. 2012. *Contextual Teaching & Learning*. Bandung: Kaifa.

Mulyana, Tatang. 2008. *Synthetic Teaching-Learning Analytics to Improve Critical and Creative Thinking Skills Mathematics High School Students*. Disertation in UPI Bandung in Mathematics Education Study Program : not published

Prastowo, Andi. 2011. *Guide of Creative Creating Innovative Teaching Materials*. Yogyakarta: Diva Press.

Suyitno, Amin, et al. 1997. *Basic and Mathematics Teaching - Learning Process.* Semarang: FMIPA Unnes.

Trianto. 2011. *Innovative Design a Progressive Teaching- Learning Model.* Surabaya: Kencana Prenada Media Group

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