

Development of Mathematic Student's Worksheet Based on Means Ends Analysis to Improve Critical Thinking Ability for Students in Class 5th Elementary School

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Abstract – This research and development aims to develop student's worksheet based on means end analysis that is feasible and interesting for fifth grade students in elementary school. The research method uses R&D. The population of the study were elementary school students for grade V in the Raden Imba Kotagajah cluster, Kotagajah sub-district, Central Lampung regency, Lampung province, Indonesia as many as 161 were distributed in 4 elementary schools. The subject of the feasibility test in this study were 3 expert lecturers and 6 practitioners, the subject of the attractiveness test of 15 students at SDN 3 Kotagajah. The data collection tool uses a instrument of feasibility test, attractiveness test and critical thinking ability test. Student's worksheet have been validated by experts and practitioner test received an average rating of 88.9 in valid with the average score 3,46 very good category. Student's Worksheet based means ends analysis interest in learning with the average score 4,38 from 5 in the interesting category. Students' responses related to five aspects of critical thinking ability after studying student's worksheet based on MEA obtained an average score of 3.19 with a good category. Based on the results of these studies indicate that the studen's worksheet products are valid, interesting and theoretically feasible to improve critical thinking ability for grade V students in Primary Schools.

Keywords – Student worksheet, Means Ends Analysis, Critical Thinking Ability.

I. INTRODUCTION

Education is a means to prepare human resources for present and future generations. Education must be able to give birth to qualified generations who have the ability and good abilities in accordance with the times. Kivunja (2015) explained that states students be explicitly taught the abilities of critical thinking and problem solving, effective communication, collaboration, as well as creativity and innovation. One of the government's efforts to prepare for better education is the application of the 2013 curriculum. The 2013 curriculum is a competency-based curriculum in

which formulating an integrated attitude, knowledge and ability competency that students must master.

Learning Curriculum 2013 applies integrated thematic learning except mathematics and physical education. Mathematics learning is an important learning because it is closely related to problem solving in daily life. Burns (2007) explained the goals of mathematics instruction today are clear—develop children's ability to think and reason mathematically and help them learn the concepts and abilities they need to do so, abilities in all of the content areas of mathematics to a range of problem-solving situations.

Students have to increase the ability to be able mathematics learning.

Fisher (2008) states that critical thinking is a mode in which the thinker improves the quality of his thinking. It is hoped that through critical thinking activities good personal individuals and arguments will be made in solving problems (Facione, 2011). According to Glaser (Fisher, 2008) "Critical thinking as: (1) an attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experience; (2) knowledge of the methods of logical enquiry and reasoning; and (3) some ability in applying those methods. Critical thinking calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends." In fact the ability of students towards mathematics in Indonesia is still low. This can be seen from the results of the 2018 PISA report (OECD, 2019). This study assesses 600,000 children from 78 countries every three years. This study compares the literacy abilities of mathematics, reading, and science performance of each child. Indonesia's ranking in the mathematics category is still relatively low, ranking 72nd with an average score of 379, which is still far from the OECD determined average score of 489. Researchers conducted observations in class V in the Gugus Raden Imba Kotagajah Elementary School, Kota Gajah Regency, Lampung Regency Middle, Indonesia that there also appears to be low learning outcomes in mathematics.

Teaching and learning process will run effectively and efficiently if supported by appropriate learning models to improve students' critical thinking ability in mathematics analyzing and finding problem solving solutions. Sweller (1989), explained that Means Ends Analysis (MEA) is a learning model that maximizes problem-solving activities, in the form of series of questions that are instruction or guidelines to help a student solve a problem (Zainal, 2018). Miftahul, (2013) states the MEA model can be applied to solve problems in learning mathematics. In addition to choosing the right learning model, the development of student worksheet that is used also needs to be done. Lee (2014) believes that worksheets can be useful in many ways including academic achievement. For example, as a supplement to books, providing additional information for certain classes, can attract learning interest and help construct learners' abilities and learning outcomes.

Furthermore, the opinion of previous research according to Bakirci, et al (2011) that the use of simulations and developed worksheets had an impact on students' critical

thinking abilities. Putra, et al (2017) explain that after testing the use of worksheets, contextual problems presented in accordance with experience have increased mathematical ability. Researchers want to innovate in developing mathematics student's worksheet based on means ends analysis to improve critical thinking ability of grade V students in elementary schools.

Based on that, this study aims to (1) develop a student worksheet based on means ends analysis based on theoretical and practitioner that is feasible and valid to increase the critical thinking ability of grade V students in elementary schools. (2) developing an attract student worksheet based on means ends analysis to increase the critical thinking ability of grade V students in elementary schools.

II. METHODS

This research is a Research and Development study, R&D, which was adopted. According to them, R&D is a development model in which research is used to design new products and procedures that are tested in the field, evaluated, and refined to meet certain criteria. Conceptually, the research and development approach includes 10 general steps by Sugiyono (2010). The subjects of this study were divided into two, namely Subject of the expert product validation trial and the subject of the usage test was the fifth grade educator in the Gugus Raden Imba Kotagajah Elementary School, Kota Gajah Regency, Lampung Regency Middle, Indonesia and students respon for attractive test and critical thinking aspect in SDN 3 Kotagajah. The object of research in this research development is a students worksheet based Means Ends Analysis to increase students' critical thinking ability. Data analysis technique is validity test by experts and practitioners, student responses test to attractiveness product and critical thinking aspect.

III. RESULT AND DISCUSSION

The results of the research described are the results of research on the development of a mathematics learning unit based on Means Ends Analysis (MEA) to improve the critical thinking skills of grade V elementary school students in SDN 3 Kotagajah referring to the steps of development research according to Sugiyono described as follows.

Potential and Problems; researchers see the potential abilities that students must have and the importance of mathematics because they are closely related to problem solving in daily life. Researchers also see the problem from the 2018 PISA survey data which shows that mathematical

ability in Indonesia is still low. At this stage the researcher made direct observations in class V of the Raden Imba Kotagajah State Elementary School to find a general picture of the problems that were obstacles in the learning process. Based on the results of observations on mathematics learning grade IV students obtained on the identification of problems.

Data Collection; data collection was carried out using questionnaire and direct observation techniques. The questionnaire was distributed to students and educators at the Raden Imba Kotagajah Public Elementary School, Kotagajah District, Central Lampung Regency. Based on the results of the distribution of questionnaires to educators and class V students obtained the following data. (1) Students have not been actively motivated when learning mathematics; (2) students have difficulty understanding the material in the worksheet used; (3) Students worksheet has not been able to facilitate the needs of students; (4) Student worksheet has not given satisfaction in developing new knowledge for students; (5) LKPD does not contain components in an arc which includes; title, content standards (KI, KD, indicators, and learning objectives), instructions for using the worksheet, learning material (core), assignments, assessment / evaluation ; (6) Student's worksheet has not helped students develop

new knowledge and also not yet helped students optimally in analyzing and finding problem solving solutions; (7) LKPD that has been prepared has not used the MEA model.

Product Design; the results of the product design stage that have been carried out by researchers are after the assessment of the product curriculum developed, namely the data presentation material class V KD 3.8 explains the presentation of data relating to students themselves and the presentation of data compares with data from the surrounding environment in the form of lists, tables, diagrams pictures (pictograms), bar charts, or line diagrams and KD 4.8 organize and present data relating to students themselves and compare with data from the surrounding environment in the form of lists, tables, picture diagrams (pictograms), diagrams bar, or line chart.

Design Validation; validation to validating students worksheet based means ends analysis products. Product validation was carried out by three expert lecturers on three aspects including material, media, and language to determine the feasibility and validity of the product, as well as to find out the weaknesses of the product as a suggestion for product improvement.

Table 1. The validation test result of 3 expert

No	Validator	Validity value	Worthiness score
1	Material expert	86,25	3,45
2	Media expert	88	3,52
3	Linguist	94,23	3,76
Average		89,5	3,58

Based on the three aspects of the validation test of material, media and language, the overall average validity score was 89.5 in the valid category and the feasibility score was 3.57 in the excellent category.

Product Design Revision; based on the results of the MEA-based LKPD trial, the next stage is the improvement and refinement of the developed LKPD. The data obtained from the validation results indicate that the product meets the theoretically feasible, valid criteria and attracts students' interest, so that students can use it. The results of expert advice are described as follows; improve writing procedures, support pictures adjusted to the material, add practice questions, revise the objectives section learning, the color of

the image and writing are adjusted so that the writing is clearly visible. Suggestions from validators are used to correct product deficiencies.

Product Testing; Product testing at this stage is carried out by a practitioner validation test and looks at students' responses to the attractiveness of the product as well as aspects of critical thinking skills after studying the LKPD independently. Validation practitioners to provide suggestions for improvement and assess the validity of the validity of the subject of the field to be developed. The trial was conducted by distributing student's worksheet and practitioners' validation test instruments, the results of which were then used as further improvement material.

Table 2. The validation test result of practitioners

No	Validator	Validity value	Worthiness score
1	Practitioner 1	86,6	3,47
2	Practitioner 1	87,9	3,51
3	Practitioner 1	86,2	3,45
4	Practitioner 1	94,8	3,79
5	Practitioner 1	85,3	3,41
6	Practitioner 1	86,6	3,47
Average		87,9	3,51

Based on Table 2 above, the average value generated is 87.9 valid categories. An assessment score of 3.51 with a very good eligibility category. Then the attractiveness test was

conducted on 15 students to see the attractiveness of the product.

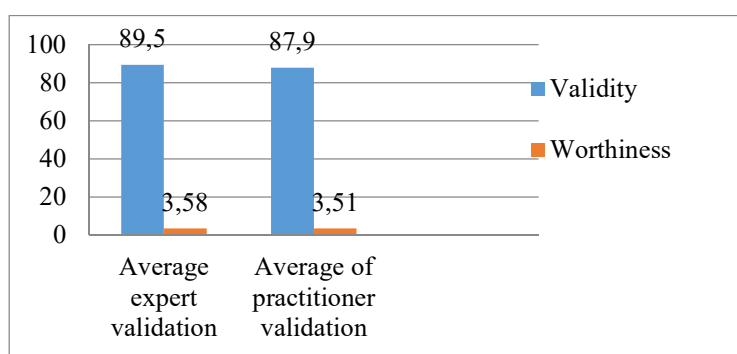


Figure 1. The results of the average validation of experts and practitioners histogram

The results above after going through the calculation of the average value of the three validations of experts and practitioners which shows an average value of 88.9 declared

valid with an average rating score of 3.46 with a very good eligibility category.

Table 3. Attractiveness test results of student's worksheet based MEA

No	Category	Convenience		Usefulness	
		Freq	%	Freq	%
1.	Very easy / very helpful	11	73,3	12	80
2.	Easy/ helpful	4	26,7	3	20
3.	Easy enough / Helpful enough	0	0	0	0
4.	Easy less / Helpful less	0	0	0	0
5.	Not easy / not helpful	0	0	0	0
Average score		4,36		4,43	
		(Very easy)		(Very helpful)	
Average overall score		4,39 (Very interesting)			

Based on the Table 3, it can be explained, in the aspect of convenience, there are 11 respondents (73.3%) who think that this worksheet is very easy, and 4 respondents (26.7%) think it is easy with an average score of 4.36 very easy categories.

The utilization aspect has an average score of 4.43 with a very useful category. There are 12 respondents (80%) argued that LKPD was very useful, and 3 respondents (20%) found it useful.

Table 4. Recapitulation of student responses regarding aspects critical thinking ability

No	Category	Analysis	Interpretation	Evaluation	Summarizes	Synthesis
		Freq	Freq	Freq	Freq	Freq
1	Very good	8	8	6	6	3
2	Good	5	6	7	9	10
3	Good less	2	1	2	0	2
4	Not good	0	0	0	0	0
Score		3,1	3,4	3,2	3,23	3,03
		(Good)	(Very good)	(Good)	(Good)	(Good)
Average score				3,19 (Good)		

Based on the recapitulation of students' responses related to five aspects of critical thinking ability after studying student's worksheet based on MEA obtained an average score of 3.19 with a good category. So that the development of mathematic student's worksheet based on MEA products has a good impact to improve students' critical thinking ability.

Product Revision; this stage revises the product based on practitioners' suggestions as field subjects by paying attention to the students' responses. The advice given as follows, the practice questions that must be varied, supported by many drawings that illustrate the material, simplify the evaluation questions. This suggestion will be used to improve the worksheet product. Based on MEA.

The initial product format development activities carried out three main activities namely (1) preparation of learning materials, (2) preparation of worksheet based on MEA development products, and (3) preparation of evaluation instruments. The three steps are explained as follows. Preparation of learning material is done by collecting learning material about "Data Presentation" obtained from learning support books and from the internet media. In addition to collecting learning material the researcher also collects images sourced from the internet, the images that have been used can be used so that the prepared student's worksheet can attract and clarify the material presented in the student's worksheet. Product preparation activities are carried out by compiling part by part, such as preface, instructions for using worksheets, SKL, KI, table of contents, KD, indicators, learning objectives, MEA learning steps consists of ways with step (1) organizing learners, (2) learning begins with problems to provide an understanding of mathematical concepts to the problems to be presented, ending consisting of steps (3) asking questions related to problems and helping to overcome problems, Analysis consists of step (4) analyze ways / design solutions to problems that have been prepared,

(5) determine the most likely solution to solve the problem (6) conclude , concept maps, learning activities, summaries, evaluations, bibliography. Evaluation instruments are instruments used to evaluate worksheets that have been prepared. The evaluation instrument used in the form of a questionnaire validation work lembar compiled using a Likert scale. The questionnaire consisted of 4 choices of answers, namely 1, 2, 3, and 4, each of which stated that it was not appropriate, not suitable, appropriate and very suitable for evaluating the quality, feasibility and validity of the developed worksheets. The worksheet validation questionnaire consisted of four validation questionnaires namely material validation questionnaire, language validation questionnaire, media validation questionnaire and practitioner validation questionnaire. Instrument attractiveness and aspects of critical thinking ability to see students' responses to worksheets.

IV. CONCLUSION

The results of the validation test after going through the calculation of the average value of the three validations of experts and practitioners that show an average value of 88.9 declared valid with an average rating score of 3.46 with a very good eligibility category. This means that it has produced a MEA-based mathematical LKPD development product that is feasible and valid to improve the critical thinking skills of elementary school students in grade V. Interest test calculations on the aspects of ease and usefulness obtained an average score of 4.39 with an interesting category. This is also supported by the results of a critical thinking ability test on students' responses on a limited basis after the distribution of mathematic student's worksheet based on MEA obtained an average score of 3,19 with good category. That means it has produced an interesting student's worksheet based on MEA development product to improve the critical thinking ability of class V students.

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