

PENGEMBANGAN PERANGKAT PEMBELAJARAN BERBASIS PENDEKATAN *REALISTIC MATHEMATICS EDUCATION* DENGAN METODE SAINTIFIK MATERI VOLUME BANGUN RUANG UNTUK SISWA SMP KELAS VIII

THE DEVELOPMENT OF TEACHING LEARNING MATERIALS BASED ON REALISTIC MATHEMATICS EDUCATION APPROACH WITH SCIENTIFIC METHOD TO LEARN VOLUME OF SOLID FOR JUNIOR HIGH SCHOOL STUDENTS GRADE VIII

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Abstrak

Penelitian ini bertujuan untuk menghasilkan perangkat pembelajaran berupa RPP dan LKS berbasis pendekatan *Realistic Mathematics Education* dengan metode Saintifik materi volume bangun ruang untuk siswa SMP kelas VIII. Kualitas perangkat pembelajaran yang dikembangkan ditinjau dari tiga aspek kualitas yaitu kevalidan, kepraktisan dan keefektifan. Metode yang digunakan adalah *Research and Development* (R&D) dengan model pengembangan ADDIE yang meliputi *analysis, design, development, implementation, dan evaluation*. Penelitian ini menghasilkan perangkat pembelajaran berupa RPP dan LKS. Penilaian kevalidan RPP mendapat skor 83,8 dengan klasifikasi valid. Penilaian kevalidan LKS mendapatkan skor 86 dengan klasifikasi sangat valid. Hasil analisis data angket penilaian kepraktisan guru dan siswa menunjukkan bahwa perangkat pembelajaran praktis dengan nilai rata-rata total 82,8. Hasil observasi keterlaksanaan pembelajaran menunjukkan klasifikasi baik dengan persentase rata-rata keterlaksanaan pembelajaran mencapai 86,7%. Hasil penilaian kompetensi siswa menunjukkan perangkat pembelajaran sangat efektif dengan ketuntasan klasikal mencapai 82,14%.

Kata kunci: perangkat pembelajaran, *Realistic Mathematics Education*, Saintifik, volume bangun ruang

Abstract

The aims of this research was to produce teaching learning materials such as lesson plan and worksheet based on Realistic Mathematics Education approach with Scientific method to learn volume of solid for junior high school students grade VIII. The quality of teaching learning materials that was developed observed in terms of three aspect of quality these were validity, practicality, and effectiveness. The method used was the Research and Development (R&D) with ADDIE model that includes analysis, design, development, implementation, and evaluation. This research was produced teaching learning materials such as lesson plan and worksheet. The validity score of the lesson plan was 83,8 with valid classification. The validity score of worksheet was 86 with very valid classification. The result of the questionnaire from teacher and student showed that the teaching learning materials was practical with total score 82,8. The result of observervation during the learning process showed good classification with percentage up to 86,7%. The result of student competency showed that teaching learning materials was very effective with percentage 82,14%.

Keywords: *teaching learning materials, Realistic Mathematics Education, Scientific, volume of solid*

PENDAHULUAN

Education is the right and duty of every citizen of Indonesia as set forth in the Constitution of article 31. As a manifestation of improved quality of education, the Ministry of Education and Culture implemented the latest curriculum i.e. curriculum 2013 which uses

Scientific methods. The steps in the Scientific method include observing, questioning, collect information, association, and communicate.

According to M. Hosnan (2014: 36) learning with Scientific method has the following characteristics.

- a. Student centered.

- b. Involve science process skills in constructing concepts, law or principle.
- c. Involve cognitive processes which potential in stimulating the development of intellect, especially high level thinking skills of students.
- d. Can develop character of students.

Mathematics has an important role in supporting education. This apparent from the mathematics became compulsory subjects at every level of education. However, mathematics is often regarded as one of the subjects that are difficult for students because it is identical to the formulas that are difficult to understand. This leads low interest student learning in mathematics lessons. Required learning strategies that fit in order to improve the quality of learning math. Teachers should seek ways to increase the motivation of learning by exposing mathematics to the world of students.

One of the learning approach to resolve the issue that is using Realistic Mathematics Education (RME). Marsigit (2010: 1) states that the math in realistic stressed to construction of concrete objects context as a starting point for students to obtain a mathematical concept. Students will be invited to build mathematical knowledge from concrete things they know and relevant with material to obtain a formal form. It will make learning to be more meaningful. According to Ausubel dalam Novak, Joseph D. (2011: 1) meaningful learning is where the learner seeks to integrate new knowledge with

relevant existing knowledge. While according to Heuvel-Panhuizen (2003: 10) the term 'realistic' refers more to the intention that students should be offered problem situations which they can imagine than that it refers to the 'realness' or authenticity of problems. However, the latter does not mean that the connection to real life is not important. It only implies that the contexts are not necessarily restricted to real-world situations. The fantasy world or fairy tales and even the formal world of mathematics can be very suitable contexts for problems, as long as they are 'real' in the students' minds.

It's required teaching learning materials to facilitate the learning process to make it more meaningful. However, teaching learning materials that comply with the 2013 curriculum is still limited so that required the development of a teaching learning materials can support the learning process. In the regulation of the Minister of Education and Culture the number 65 by 2013 about standard processes and number 103 by 2014 about learning in primary and secondary education, hinting that the teacher must develop a teaching learning materials in the form of lesson plan and worksheet refers to the standard learning contents. Lesson plan is face-to-face learning activities plan for one or more meetings (M. Hosnan, 2014: 99). After compiling a lesson plan, the teacher can also develop the student's worksheet. According to Depdiknas (2008: 13), the student worksheet are sheets containing the tasks that must be carried out by students. Benefits of student worksheet for students can help understand the material and concepts being discussed.

One of the scope of the learning of mathematics at junior high school was geometry. Material of geometry are discussed in class VIII is solid include the cube, beams, prism, and limas. Material of solid especially the volume of solid will be quite abstract if it is taught without the use of the media. Therefore it needs media which can support learning in the form of props, picture, video , or worksheet as capable of facilitating and ease students in learning volume of solid.

From the explanation above is seen as important as learning devices can facilitate students in order to be able to build on his mathematical knowledge becomes more meaningful especially in the material-volume of solid. It can be realized when available teaching learning materials developed with learning contains realistic issues about volume of solid in accordance with the applicable that is curriculum 2013.

There is some research related to the development of a teaching learning materials, Realistic Mathematics Education, Scientific, volume of solid, and junior high school students of class VIII. Research conducted by Atmini Dhoruri, dkk (2011) with the title *Developing Mathematics-Students Worksheet Based On Realistic Approach For Junior High School In Bilingual Program* using the research model development *Borg and Gall* produced a valid and practical student worksheet. According to the results of the response of students found that the students worksheet which developed very interesting, exciting and can help the students to comprehend the concept. The research of Maprokhi (2015) about the development of the

teaching learning materials of learning mathematics junior high school class VIII even semester with Scientific approach using development model *Four-D* produced a valid, practical, and effective teaching learning materials. The research of Harna Yulistiyarini (2015) about the development of teaching learning materials to learn geometry space for junior high school with utilizing manipulative props and environment using a model *Four-D* also produced a valid, practical, and effective teaching learning materials. According to Nieveen (1999: 126), a product of the development of teaching learning materials must meet the criteria validity, practicality, and effectiveness. If the device has met the third learning aspect then deserves to be used.

Therefore, researchers will conduct research on the development of teaching learning materials based on Realistic Mathematics Education approach with Scientific methods of the material volume of solid for junior high school students class VIII who met validity, practicality, and effectiveness.

RESEARCH METHODS

Research methods used in this research is a Research and Development (R&D) with the ADDIE model consists of five stages, namely Analysis, Design, Development, Implementation, and Evaluation by Dick and Carry (1996).

Time and Place of Research

This research was carried out in April-May in MTs N Yogyakarta 1, Magelang Street km 4.4, Sinduadi, Mlati, Sleman, Yogyakarta.

The Subject of Research

This subject in the development research is students of class VIII B MTs N Yogyakarta 1 totalling 28 people.

Procedure

The development phase with ADDIE model according to Endang Mulyaningsih (2012: 183) is as follows.

1. *Analysis*

At this stage, the main activity is to analyse the need for development of new learning methods/models and analyze the feasibility and terms of development of new learning methods/models. The analysis phase loads an analysis of needs, an analysis of the curriculum, and an analysis of the characteristics of students.

2. *Design*

This activity is a systematic process that starts from the set learning objectives, designing scenarios or teaching and learning activities, designing teaching learning materials, designing learning materials and student assessment tools. At this phase the researchers also devised instruments that will be used to assess teaching learning materials that will be developed. The instruments are arranged with attention to three aspects of quality, namely validity, practicality, and effectiveness.

3. *Development*

The development phase in the model ADDIE contains an activities of the realization product. At this phase the

development of the lesson plan and student worksheet as done in accordance with the design in the design phase. Then, the lesson plan, worksheet, and test the result of study will be validated by expert lectures material, media experts and teacher of subjects in the school use assessment instruments have been drawn up at the previous phase. Validators are required to pass judgment, advice and comments. The validation process is performed to a device that is use has been declared valid and deserves to be implemented by a third validators.

4. *Implementation*

At this phase the teaching learning materials that have been developed are implemented on the real situation in class. The implementation is done in limited release in selected schools as a place of research. At this phase carried out a test run of the product and the product test result analysis.

5. *Evaluation*

At this phase of evaluation, researchers did a revision of a teaching learning materials which developed based on suggestions and comments from questionnaire from response and observation sheets. It is aimed so that the teaching learning materials which developed really appropriate and can be used by the wider school.

Data Types and Data Collection Techniques

The data used in this research is qualitative data and quantitative data. Qualitative data consists of suggestions or comments on the

assessment sheet of lesson plan and worksheet by the validator and practicality of assessment questionnaire form teacher and students. Whereas the quantitative data in the form of a judgement given on the assessment sheet of validity, practicality, and value of students. Data collection techniques in this research using observation, questionnaire, test, and documentation.

Research Instrument

The research instrument of teaching learning materials that was developed in this research consist of assessment sheet of teaching learning materials, questionnaire of practicality by teacher and students, observation sheet, tests, and assessment sheet attitude. Instruments drawn up used to get associated data of validity, effectiveness and practicality.

Data Analysis Techniques

A. The Qualitative Data

The data used in this research is qualitative data and quantitative data. Qualitative data consists of suggestions or comments on the assessment sheet of lesson plan and worksheet by the validator and practicality of assessment questionnaire form teacher and students analyzed in qualitative descriptive. This analysis as material revision device that was developed.

B. The Quantitative Data

1. Analysis of The Quality of Validity

Analysis of the quality of the instrument using questionnaire research of teaching learning material for content expert, media expert, and

- a. Calculate the average score obtained by the formula:

$$\bar{x} = \frac{\sum x}{n},$$

with

\bar{x} = average score

n = the number of validator

$\sum x$ = the amount of score obtained

- b. Convert the average value obtained into the qualitative data.

2. Analysis of The Quality of Practicality

The instruments used to assess quality of practicality is questionnaire from students and teachers. Analysis of practicality done with steps as follows.

- a. Change the qualitative data into quantitative data with the likert scale answer option scoring. A question or statement that has a positive score answers is: SS = 5, S = 4, KS = 3, TS = 2 and STS = 1, while the question or statement negative score answers is: SS = 1, S = 2, KS = 3, TS = 4 dan STS = 5.
- b. The next steps are the same as the steps for calculating the quality of validity.

3. Analysis of The Quality of Effectiveness

The instruments used to analyze the effectiveness of the use of the teaching learning materials is the assessment of attitude and knowledge in the form of tasks and tests.

a. Minimum Competency Achievement Of Attitude

Analysis of effectiveness of competency attitude is done with the following steps.

- 1) Calculate the score using formula:

$$\frac{\text{Skor diperoleh}}{\text{SkorMaksimal}} \times 4 = \text{skor akhir}$$

- 2) Convert the value of an average attitude of qualitative values into predicate A-D in accordance with the criteria in Appendix Permendikbud number 81a in table 1. as follows.

Table 1. Conversion of Attitude Assessment

Predicate	Score Of Attitude Competency	Scale Of Assessments Attitude
A	4	SB (Very Good)
A-	3,66	
B+	3,33	B (Good)
B	3	
B-	2,66	
C+	2,33	C (Enough)
C	2	
C-	1,66	
D+	1,33	K (Less)
D	1	

b. Minimum Competency Achievement Of Knowledge

The achievement of minimum competency of knowledge based on the minimal score of school is 70. Competency assessment of knowledge based on two tests instrument that is the value of a process based on exercises and tasks as well the value of the end of the test results of the study. The determination of the final score for knowledge with following the steps.

- 1) Calculate a value in the learning process, that is the value of the exercises.
- 2) Calculate the average score obtained by the formula:

$$\bar{x}_{pb} = \frac{\sum x_i}{n},$$

with

\bar{x}_{pb} = average score of learning process

$\sum x_i$ = the number of scores earned from each exercises

n = the number of tests or exercises

- 3) Calculate the value of the test results of the study (x_{hb}) based on the rubric that has been validated.
- 4) Calculate the average score obtained by the formula:

$$\bar{x}_p = \frac{\bar{x}_{pb} + x_{hb}}{2}$$

With \bar{x}_p is the average score value of knowledge competencies.

The assessment of the aspect of the affectiveness of each competency is done by following the steps as follows.

- 1) Calculate the average value of the student's assessment on each competency.
- 2) Counting the number of students who pass the minimum score of attitude competency who get value is greater than or equal to B and pass each competency of knowledge by getting the value of 70 based on minimal score in the school.
- 3) Calculate percentage of completeness in classical each competence by using the following formula.

$$p = \frac{L}{n} \times 100\%$$

With p is the percentage of students completeness in classical, L is the number of students who pass the minimum score, and n is the total number of students.

validation is done to know the validity of the lesson plan before trial. The lesson plan validated by expert lectures of material and mathematics teacher class VIII of MTs N Yogyakarta 1. Table 2. is the assessment results of lesson plan from experts.

Table 2. The Results of The Data Analysis Validity Of Lesson Plan

ASSESSMENT DATA ANALYSIS RESULTS OF LESSON PLAN	
The average total	83,8
Validity criteria of lesson plan	Valid

The results of the assessment of the lesson plan by expert teachers and mathematics teacher can be seen in table 2. That is shows the average value of 83,8 with valid classification. Based on those research, the lesson plan is said to be valid to be used.

2. Validity Of Worksheet

A worksheet that has been developed is validated by expert material, expert media, and mathematics teacher. Validation is performed to find out the validity of worksheet before trial. Table 3 is the result of the assessment of worksheet by experts.

THE RESULTS OF THE RESEARCH AND THE DISCUSSION

A. Validity

1. Validity Of Lesson Plan

The lesson plan has developed, validated by expert material. This

Table 3. The Results of The Data Analysis Validity Of Worksheet

ASSESSMENT DATA ANALYSIS RESULTS OF WORKSHEET	
The average total	86
Validity criteria of worksheet	Very Valid

The assessment results of worksheet by experts who can be seen in the table 3 shows the average score is 86 with very valid classification. Based on those results, a worksheet it can used. After the validation is done by expert lectures and teachers, then the teaching learning materials implemented to the 28 students of class VIII B MTs N Yogyakarta 1.

B. Practicality

The practicality of the teaching learning materials in this research measured using questionnaire practicality of the filled in by teachers and students. The results of the data analysis questionnaire practicality that has been carried out after the test results of the study can be seen in table 4..

Table 4. The Results Of The Data Analysis of The Practicality Of Teaching Learning Materials

The Average Assessment Aspects	Questionnaire of Response		The Average Total
	Teacher	Student	
The benefits	82,6	80	81,4
The ease	83,4	85,2	84,4
The average of	83	82,6	82,8

The Average Assessment Aspects	Questionnaire of Response		The Average Total
	Teacher	Student	
questionnaire			
The criteria of practicality	PRACTICAL	PRACTICAL	PRACTICAL

The results of the data questionnaire assessment of practicality from teachers and students after using the teaching learning materials that developed obtained average value from questionnaire of teacher's response is 83 and from student's response is 82,6. The teaching learning materials get practical classification with a total value of average 82,8.

Observation during the lesson is used to find out the percentage of continuity learning using teaching learning materials that have been developed. The results of the observational data analysis of the learning can be seen in table 5.

Tabel 5 Hasil Analisis Data Observasi Keterlaksanaan Pembelajaran

No	RPP	Materi	Kls/Wkt	Persen.	Krit.
1	RPP ke-1	Volume Kubus dan Balok	VIII B Mon, April, 25 2016	90%	Very Good
2	RPP ke-2	Volume Prisma	VIII B Wed, April, 27	80%	Good

No	RPP	Materi	Kls/ Wkt	Persen.	Krit.
			2016		
3	RPP ke-3	Volume Limas	VIII B Mon, May, 2 2016	90%	Very Good
Percentage Of Learning				86,7%	Good

Overall, the learning process is said to be good with percentage reached 86,7%.

C. Effectiveness

In the phase of testing the product obtained the data that include the value of knowledge and attitude competencies of students. The data to find out the value of the effectiveness of the teaching learning materials.

Table 6. The Results Of The Data Analysis The Effectiveness Of Teaching Learning Materials

Aspects Of Assessment	The Average Value	Percent of Completeness	Caption
Attitude Assessment	3,12	100%	Very Effective
Assessment Of Knowledge	78,59	82,14%	Very Effective
Percentage of Classical Completene s	82,14%		Very Effective

Based on the learning process using the teaching learning materials that has been developed, the results of data analysis assessment of students knowledge and attitude meet the criteria very effective with percentage reach 82,14%.

CONCLUSION AND ADVICE

Conclusion

Based on the research results and discussion outlined earlier, then it can be conclude the development research was produced a product in the form of a lesson plan and worksheet based on *Realistic Mathematics Education* approach with Scientific methods of the material volume of solid for junior high school students class VIII. This research use the ADDIE model of the development which includes *analysis, design, development, implementation, and evaluation*.

The results of the assessment of teaching learning materials made by two expert lectures and teachers of mathematical subject showed that the device which developed is valid. The assessment of lesson plan by expert lecturers and mathematics teachers get score 83,8 with valid classification. The assessment of worksheet by materials expert, media expert and mathematics teacher get the score average of 86 with very valid classification.

The results of practicality questionnaire by teachers and students as well as the results of the observation during learning process showed that teaching learning materials is practical. The results of practicality questionnaire by a teacher

got the score 83 with practical classification. The results of practicality questionnaire by students got the score 82,6 with practical classification. Based on that results, the teaching learning materials is said to be practical with average value of the total 82,8. In addition, the results of the observation during learning process showed good classification with percentage reached 86,7%.

The result of the assessment of the attitudes and knowledge attained by the students after using a teaching learning materials indicate that the device is very effective because the learning meets the classification of classical completeness reached 82,14%. The results of the assessment of the attitude of students reached 100% with the average value 3,12. The results of the competency assessment of student knowledge reached 82,14% with an average score of 78,59. .

Advice

Here is an advice that can be delivered based on the findings of the research conducted.

1. The teaching learning materials such as lesson plan and worksheet based on Realistic Mathematics Education approach with Scientific methods to learn volume of solid for junior high school grade VIII which develop has meet good criteria with valid, practice and effective so that it can be used with learners or teachers in support of learning volume of solid in the class.
2. The teaching learning materials of mathematics developed in this research are still limited to a single subject matter i.e. volume of solid. Therefore, other researchers can develop teaching learning materials using

other subject matter but with the same procedure as used in this research.

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