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Development of Fraction Learning Devices Material by using a Realistic Mathematical Approach to Improve Students' Learning Outcome in Fourth Grade of Elementary School

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Abstract:- The objectives of this study are (1) to describe the quality of good Learning devices on validity, effectiveness and practicality, (2) to describe improvement in learning outcomes of fourth grade Elementary School students by using realistic mathematical approaches in fraction material. This research is a development research by using 4-D model that is defining, designing, developing and disseminating. The validation results proved that the learning devices is valid and ready to use. Furthermore, the learning devices was tested by using One Group Pretest-Posttest Design in fourth grade class of Klampis Ngasem V Elementary School Surabaya. The results of this development showed that (1) learning devices have good quality because they achieved the following requirements; the validator's assessment of the learning devices is in a score of 4 in the valid category, the ability of the teacher to manage learning and student activities in a good category, that is more than 75% of students get A score above the minimum competence criteria (KKM) which shows that student learning outcomes are complete, and the student's positive response to the learning devices indicated by more than 75% of students gave their opinion that they were happy, get new method, clear explanation and interest in learning this material, (2) student learning outcomes of using a realistic mathematical approach has increased with gain score of 0.7.

Keywords:- *Realistic Mathematic Approach, Fraction Material.*

I. INTRODUCTION

In mathematics subject, the understanding of essential concepts is very important. A good understanding of the concept will make students put these concepts in the long-term memory system and can use them at a higher level of thinking such as problem solving and creative thinking. Mathematics in Elementary School consists of integers, fractions, geometry and statistics.

Fractions are an important part of the basic education curriculum. Students' understanding of fractions must be optimal and students must really understand the concept of fractions. It happens because almost all the fraction material taught in Elementary School is the basis of mathematics subject in the Middle level. This is in line with the statement of Mamede & Oliveira (2010) which revealed that fractions are fundamental concepts in mathematics and will affect other higher concepts. The ability of students to operate fractions is one indicator to determine the success or failure of students in solving mathematical problems, both in solving math problems in school and in everyday life. So if students do not know the basic concepts of fractions, students will have difficulty in finishing the fraction problem.

The results of observations which is done by researchers at the inquiry practice showed that fourth grade students still did not understand the concept of fractions and recognize various types of fractions. At that time, researchers also tried to apply realistic mathematical approaches in fraction learning and the results showed that students' understanding of fractions began to appear. Students also begin to be interested in participating in this learning, so the notion that mathematics is difficult changed as a fun learning. Researchers also interviewed the teachers about realistic mathematics, most of them did not even know what realistic mathematics was. This is the basic for researchers to conduct research on fourth grade students on fractions by using realistic mathematical approaches.

When the teacher taught mathematics by using a realistic mathematical approach create more meaningful learning to the students, because it oriented to the problems in daily life and applies mathematics in daily life. According to Hadi (2017) a realistic mathematical approach is a effective approach in learning mathematics. Teachers are required to be able to develop interactive learning and provide opportunities for students to participate actively in their own learning process.

The result of realistic mathematics learning has been done by several researchers. Yuliana Batlyakru (2015) has developed learning devices by using a realistic mathematical approach to conclude that learning devices development have good quality, so that the completeness of learning outcomes can be achieved and the use of realistic mathematics learning to teach fractions in elementary school. The study was conducted by Sri Imelda Edo and Damianus Dao Samo (2017) who concluded that learning used realistic mathematical approaches, made students very enthusiastic and enjoyed all learning activities because they learned through playing, drawing, coloring, cutting and composing colored origami paper. Students not only understand the concept of simple fractions, compare simple fractions, and solve problems related to simple fractions but also they have been involved in activities related to the concept of addition and multiples of fractions.

Based on the description above, the researcher wants to conduct research with the title "Development of Fraction Learning Materials Using Realistic Mathematical Approaches to Improve Learning Outcomes of Class IV Elementary School Students".

II. METHOD

This research is a development research use 4-D model, where 4-D model has 4 stages, that is defining, designing, developing, and distributing. This research develops learning devices by using realistic mathematical approaches in fraction material for students in fourth Grade of Elementary School. Learning devices developed in this study include the lesson plan (RPP), Student Worksheet (LKPD), and Learning Outcomes Test (THB).

The study was conducted at Klampis Ngasem V Surabaya Elementary School. The subject of the study are fourth grade students in the 2018-2019 academic year where fourth A grade is an experimental class, while an implementation of the device which is part of the deployment stage is fourth B grade. The number of students from both classes is the same, they are 27 students. Experimental of learning devices developed by using One Group Pretest-Posttest Design. The design can be seen in the following table.

Kelas	*Pre-test*	Perlakuan	*Post-test*
experimental	T1	X	T2
Information			
T1 :	Pre-test, aims to determine the level of students' initial understanding before being treated.		
X :	Treatment, is a learning activity by using learning tools with realistic mathematical approaches.		
T2 :	Post-test, aims to determine the level of understanding of students about the material after being treated.		

Table 1

The purpose of data analysis is to determine the quality of mathematical learning devices in fraction material by using realistic mathematical approaches. Analysis of learning device development data is described as follows:

A. Analysis of the Validation Learning Device Results

The Validation learning device consists of lesson plan (RPP), Student Worksheet (LKPD), and Learning Outcomes Test (THB). The results of the validation were then analyzed in descriptive quantitative, by calculating the average score of the assessment from the validator. The average score obtained is converted by using the following conditions:

Interval Validation score	Scoring category	Information
$3,6 \leq SV < 4$	Very Valid	Can be used without revision
$2,6 \leq SV < 3,5$	Valid	Can be used with a slight revision
$1,6 \leq SV < 2,5$	Less Valid	Can be used with many revisions
$0,6 \leq SV < 1,5$	Invalid	Cannot be used, it still requires consultation

Table 2:- The Criteria of Categorizing the Validity of Learning Devices

Information:

SV = validation score (Ratumanan & Laurens, 2011)

B. Analysis of Observation Data

➢ *Analysis of Student Activity Data*

Analysis of student activity is activity data seen during learning process. The percentage of student activity observations is calculated using the following formula.

$$precentage = \frac{the\ frequency\ in\ every\ observation\ aspects}{the\ number\ of\ all\ observation\ aspects\ frequency} \times 100\%$$

➢ *Data Analysis of Teacher's Ability in Managing Learning*

Data of teachers' ability in managing learning were analyzed by using descriptive statistics with an average score. To determine the level of ability of the teacher in managing learning, it is carried out by using the following formula.

$$TKG = \frac{the\ \text{number of score obtained from aspects assessed}}{\text{maximum score of all aspects assessed}} \times 5$$

Information: TKG = Teacher's ability level

The results of the assessment are matched to the criteria for the teacher's ability to manage learning in the following table.

No.	TKG average score	Information
1	$1,00 \leq TKG \leq 1,50$	Bad
2	$1,50 \leq TKG \leq 2,50$	enough
3	$2,50 \leq TKG \leq 3,50$	Good enough
4	$3,50 \leq TKG \leq 4,50$	Good
5	$4,50 \leq TKG \leq 5,00$	Very good

Table 3:- Criteria for Teacher's Ability in Managing Learning
(diadopsi dari Hobri:2010**)**

C. Analysis data of Learning Outcomes Test

Data obtained from learning outcomes are processed to determine the completeness of learning outcomes. In addition, an analysis of the validity and reliability of the test was carried out.

➢ *Completeness of Learning Outcomes*

The completeness of student learning outcomes can be determined using the following formula.

$$completeness\ of\ learning\ outcome = \frac{total\ score}{maxium\ score} \times 100$$

➢ *Validity*

To find out whether the test has empirical validity or not, it can be done by correlating the scores which obtained on each item with a total score. If the score of items / items arranged is positively correlated with the total score, then it can be said that the test has validity. To find out the validity of the item, the moment product correlation formula can be used as follows.

$$r_{xy} = \frac{N\sum_{i=1}^{n} X_iY_i - (\sum_{i=1}^{n} X_i)(\sum_{i=1}^{n} Y_i)}{\sqrt{\{N\sum_{i=1}^{n} X_i^2 - (\sum_{i=1}^{n} X_i^2)\} - \{N\sum_{i=1}^{n} Y_i^2 - (\sum_{i=1}^{n} Y_i^2)\}}}$$

Information

r_{xy}	=	the magnitude of the correlation coefficient that shows the validity of the item
N	=	The number of students who are taking the test
X_i	=	The score of each item whose validity is calculated
Y_i	=	total score obtained by students
$\sum_{i=1}^{n} X_i$	=	the number of scores for each item whose validity is calculated
$\sum_{i=1}^{n} Y_i$	=	The number of total scores obtained by each student
$\sum_{i=1}^{n} X_i^2$	=	The number of squares of scores for each item whose validity is calculated
$\sum_{i=1}^{n} Y_i^2$	=	The number of squares of scores for each item obtained by students

The following is a table of validity criteria to determine the validity level of the instrument.

Coefficient of Validity	Interpretation
$r_{xy} \leq 0,00$	Invalid
$0,00 < r_{xy} \leq 0,20$	Very low validity
$0,20 < r_{xy} \leq 0,40$	Low validity
$0,40 < r_{xy} \leq 0,60$	Enough validity
$0,60 < r_{xy} \leq 0,80$	high validity
$0,80 < r_{xy} \leq 1,00$	Very high validity

Table 4:- Instrument Validity Criteria (Arikunto:2013)

➢ *Reliability*

A test is said to be reliable if the test results are relatively fixed if used for the same subject. Alpha formula is used to find reliability tests with the following formula.

$$r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum S_i^2}{S_t^2}\right)$$

Information

r_{11}	=	reliability
n	=	The number of questions
$\sum S_i^2$	=	The number of variants score for each item
S_t^2	=	total score variant

The following is a table of criteria for reliability of learning outcomes tests

Coefficient of reliability	Interpretation
$0,80 \leq r$	Degree of high reliability
$0,40 \leq r < 0,80$	Degree of moderate reliability
$r < 0,40$	Degree of low reliability

Table 5:- Criteria for Instrument Reliability (Ratumanan,:2011)

D. Analisis Data Angket

Data angket dianalisis dengan menentukan persentase siswa yang memberikan jawaban berupa respon terhadap perangkat pembelajaran. Analisis angket menggunakan statistik deskriptif dengan persentase sebagai berikut.

$$persentase = \frac{jumlah\ respon\ positif\ siswa\ tiap\ aspek\ yang\ muncul}{jumlah\ seluruh\ peserta\ didik}\ x\ 100\%$$

E. Questionnaire Data Analysis

Questionnaire data were analyzed by determining the percentage of students who gave answers in the form of responses to learning devices. The questionnaire analysis uses descriptive statistics with the following percentages:

$$N - Gain = \frac{(posttest\ score - pretest\ score)}{(maximum\ ideal\ score - pretest\ score)}$$

The result of N-Gain normalization is classified into three categories, those are:

The average of *N-Gain*	Classification
N-Gain ≥ 0,7	High
0,7 > N-Gain ≥ 0,3	Moderate
0,3 > N-Gain	Low

Table 6:- *N-Gain Classification* (Hake:1999)

III. RESULT

The following are the results of achieving the criteria for a good learning device.

No.	Criteria	information	Category
1	Evaluation of the validator on the learning device.	In general, the score is 4	Valid
2	The ability of the teacher to manage learning in the class.	The score is 4	good
3	Student activities during learning activities.	It is the range of 61% -80%	Effective
4	Students' learning outcomes	Lebih dari 75% siswa mendapatkan nilai di atas KKM	completed
5	Tests for learning outcomes	Validitas > 0.40 Reliabilitas > 0.40	Valid Reliabelity
6	Student responses to learning devices.	More than 75% of students feel happy, get new knowledge, clear explanation and interested opinions	Positive

Table 7

Based on the table above, it can be concluded that the learning device in the fraction material by using a realistic mathematical approach achieved in a good criteria to find out the improvement of student learning outcomes at the pretest and posttest in the learning by using realistic mathematical approaches to fraction material, then an N-gain score analysis is performed. The following is a description of improving student learning outcomes.

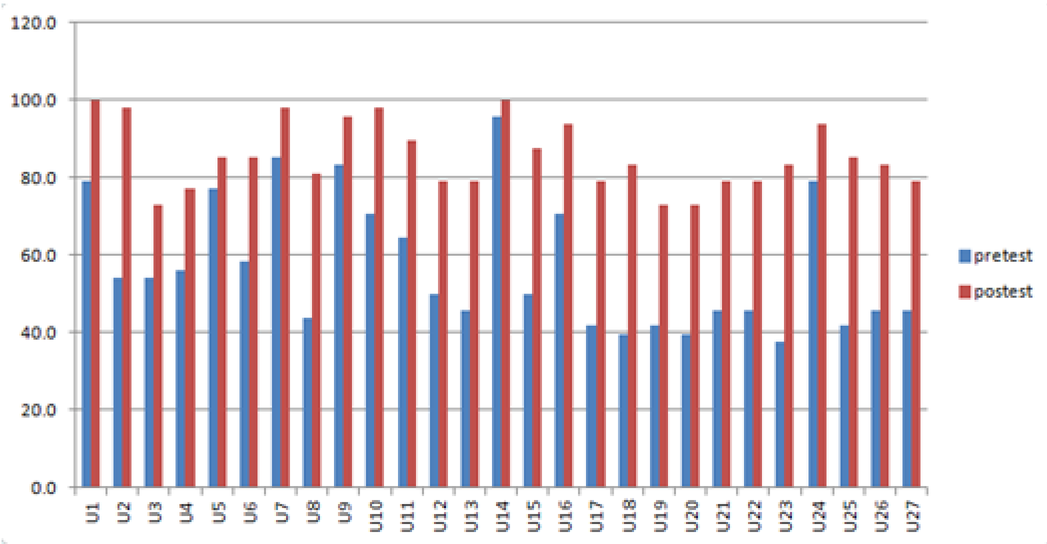

Fig 1:- The Improvement of student learning diagrams

Based on the two diagrams above, the information was obtained that the average test scores of student learning outcomes achieved at the pretest and posttest had increased.

IV. DISCUSSION

Validated learning devices consist of lesson plan (RPP), Student Worksheets (LKPD) and Learning Outcomes Test (THB). The results of the validation of the learning device, in general, the validator gives a score of 4 in the valid category. Based on these assessments the learning devices can be used with small revision. Data related to the effectiveness and practicality of learning devices are obtained through observations, the completeness of student learning outcomes and positive responses provided by students during learning activities.

The observation results of the teacher's ability in managing the class is obtained an average score of at least 3 with the achievement of TKG score which was 4.24 included in the good category. Observation results of student activities during the learning activities take place, it is known that student activities are in a good category (61% -80%). The most dominant student activity is shown by the enthusiasm of students during the learning activities. Students' responses to learning show that more than 75% of students feel happy, get new knowledge, clear explanation and interested in this learning.

Students are said to be complete in the learning process if the average achievement gets the minimum completeness criteria (KKM). Student learning outcomes in the pretest showed that students who get cored on the minimum completeness criteria were only 6 students. While at posttest there were 24 students or 89% of all students taking the test and obtaining grades above the minimum completeness criteria (KKM). This shows that learning can be said to be complete.

The learning outcome test is done twice, those are the pretest and posttest. Pretest scores are used to determine the level of understanding of students before using realistic mathematical approaches to fraction material. From the results of the pretest, the average score of students was 57 in the experimental class while in the class the implementation of the average value of students was 55. The posttest scores were obtained by students after learning using realistic mathematical approaches. From the posttest results in the trial class, the average value is 85.6, while in the Class implementation the average value is 85.8. Improving student learning outcomes tests is indicated by the results of analysis using N-gain. N-gain scores test student learning outcomes are in the high category indicated by an increase in scores at the pretest and posttest. This shows that the application of learning devices using realistic mathematical approaches to fraction material can improve student learning outcomes.

V. CONCLUSION

Based on the results of the study, it can be concluded that the development of learning devices using realistic mathematical approaches has good quality (valid, effective, practical) and can improve student learning outcomes.

SUGGESTION

Based on the results of the research that has been done by the researcher, there are several suggestions, those are: Development of learning devices by using realistic mathematical approaches which can be used as an alternative in learning material for dourth grade of Elementary school students.

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