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Developing of Student Workbooks (LKS) Based on Relating, Experiencing, Applying, Cooperating and Transferring (REACT) to Facilitate Mathematical Connection Ability of Junior High School Students

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Abstract

This research contains the Developing Student Workbook (LKS) as a REACT (Relating, Experience, Applying, Cooperating, and Transferring) based teach material as a learning model to improve student's mathematical connections abilities. the background of this research is because there are still many teach materials in the form of LKS that are not suitable to meet the needs of student's mathematical connections abilities in learning mathematics. In facts, the abilities of mathematical connections is very important because it helps in the formation of students perceptions in mastering concepts and solved problem-solving tasks through the relationship of mathematical concepts with concepts in other disciplines. the purpose of this study is to develop REACT model-based LKS as a valid, practical, and effective teach material to improve students' mathematics connections skills. this research is development research (R&D) with the ADDIE model. the subjects in this study were students of class VII MTs. the data collections technique used consists of a questionnaire deployments technique to obtain data on the validity and practicality of LKS and a test technique to obtain data related to mathematical connection abilities after using REACT model-based LKS. The data analysis technique used is a qualitative descriptive analysis technique in processing qualitative data on the questionnaire for the improvements of LKS and technical quantitative descriptive analysis in processing data in the form of numbers and percentages to describe the results of the questionnaire test and validation test, practicality, and effectiveness. the results showed that the REACT learning model-based LKS is valid, practical, and effective to facilitate students' mathematical connections abilities in the mathematics learning process.

Keywords: LKS, REACT Model, Mathematical Connection Capabilities

Introduction

Mathematics is a systematic science that requires people who study it to continue to develop with the concepts they already have. Mathematics it is also the basis for other scientific disciplines so that mastering mathematics will make it easier to learn other sciences which at the same time make human daily activities easier. So that mathematics be one eye lesson incoming tree to in National Examination (UN) and studied throughout level education.

As a subject that must be followed by students, of course there is a standard of ability to be achieved. According to the NCTM (National Council of Teacher of Mathematics) process standards in learning mathematics there are 5, namely problem-solving ability, reasoning ability, communication ability, ability to make connections, and representation ability. (Badjaber, 2015)

One must ability achieved student is ability connection math. According to Ruspiani (Sumarmo, 2007) that mathematical connection ability is the ability to link mathematical concepts both between mathematical concepts themselves and to relate mathematical concepts to concepts in other fields. According to (Jamawi, 2011) mathematical connections is based on that math as body of Knowledge is knowledge that is structured and intact, consisting of interrelated parts. In addition, mathematics is a basic science that is used as a tool in the development of other sciences and the third is mathematics as a science that can be used directly in solving the problems of human life.

Through mathematical connections, the concept of thinking and students insight into mathematics will be wider, not only focused on a particular topic being studied, but also helping to form student perceptions, by seeing mathematics as an integrated part of life. In this regard, learning mathematics requires an emphasis on material that leads to a relationship in mathematics both with mathematics itself and with other materials. Mathematics is not taught separately between topics. Each

topic can be involved or involved with other topics. Therefore, students understanding of one topic will help to understand another topic.

In the 2013 curriculum implemented by the government moment this also requires ability math. this looks at the steps approach scientific knowledge applied to the 2013 curriculum. According to Yani (Suhartati, 2016) steps approach science in the 2013 curriculum namely observing, asking, trying/collecting data (information), associating or process information, and communicate. But in fact, according to (Linto *et al.*, 2012) in visible learning student still difficult connect the material they are learn with material prerequisites already they master. Learned concepts no last long inside memory students, consequently ability connection they not optimal.

Based on results interview the researcher do with two subject teachers math at the junior high school level stating that part big student experience difficulty in connect draft mathematics with subject concept other as well as with life everyday. In addition, students are also lacking active so it's difficult for the teacher in explore students ideas, even though the teacher has use various learning models and various material teach to handle problem And support the learning process.

one material teaching used in the learning process is LKS (Developing Student Workbook). LKS contains activities that must be carried out by students to achieve indicators of achievement of learning outcomes. LKS can be used as guidelines so that students can carry out active activities in learning and help direct students to construct the knowledge, they have learned to solve a problem. Based on results interview the researcher do to a number of student junior high school show that LKS as material teaching provided by school not always used in the learning process because not enough in accordance for need and understanding student. This seen from less covers interesting, the questions presented too short and difficult understood, the pictures on the problem not enough interesting, explained material as well as example question given not enough complete and clear so that student difficulty understand it independently.

In addition, LKS is available not yet capable facilitate ability connection mathematical student. This can seen from results observation researchers on students class VII junior high school given a number of question connection mathematical in LKS form shows average mark results students on questions the is 54% and seen weak ability student in hook material into the life daily and hook new material with material that has passed.

Because it, researcher do study LKS development that can facilitate ability connection mathematical student. (Muslich, 2011) One of the learning models that can entered into LKS is a learning model REACT. REACT is an acronym for Relating, Experiencing, Applying, Cooperating and Transferring. Through existing concepts in the learning model this, students will do learning activities such as searching, processing, connecting and finding more concrete learning experiences. REACT models this is suite activity student in hook material with life everyday, experience, implement, cooperation and transfer knowledge that has obtained for solve problem in real world life. After draft understood, then student can apply knowledge and information presented in context utilization, for example in activity finish questions, and can also be used in context new or situation new.

Method
Study this produce something product from improvement product previously with the analysis process material and test product use study R&D development. The research model used is the ADDIE model because suitable used as a research model for development material teach in the form of workbooks. Following is ADDIE research model cycle:
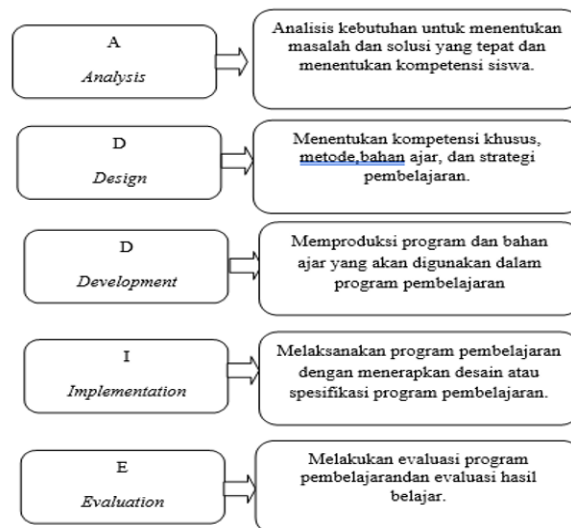

Fig 1: The cycle of the ADDIE research model

As for the subjects in the study This is student Class VII Junior High School. Data collection techniques used namely questionnaire and technical distribution techniques test. deployment technique questionnaire done for obtain validity and practicality data. For obtain validity data, questionnaires spread to 4 validators namely lecturer and 1 school teacher concerned, and for obtain practicality data questionnaire spread to students who receive LKS. Test techniques were carried out to obtain effectiveness data related to mathematical connection ability after using the REACT model-based workbook. Data collection instrument in the form of sheet validity (validity material and media design, validity questionnaire response students, and validity question), sheet acquired practicality from questionnaire response students, and sheets the effectiveness obtained from activity data students and outcome data study student. As for ratings sheet validity and practicality using a scale format calculation rating scale, with range value 1 to 5.

Table 1: Criteria Score Evaluation Validation and practicality

S. No	Criteria	Score
1	Very Good	5
2	Good	4
3	Enough Good	3
4	Less Good	2
5	Very No In accordance	1

Next, for determine validity and practicality of LKS, done processing score answer so that produce mark percentage in accordance with validity and practicality data criteria that have been compiled with formula as following:

$$\text{Level validity} = \frac{\text{Skor yang diperoleh}}{\text{Skor tertinggi}} \times 100\%$$

Then, results validation and practicalization obtained be measured with criteria validity and practicality as following:

Table 2: Data Criteria for the Validity and Practicality of LKS

S. No	intervals	Criteria validity	Criteria Practicality
1	k > 80	Very Valid	Very Practical
2	60 < K ≤ 80	Valid	Practical
3	40 < K ≤ 60	Valid Enough	Enough Practical
4	20 < K ≤ 40	Invalid	Less Practical
5	K ≤ 20	Invalid	No Practical

The data analysis techniques used in study This namely qualitative descriptive analysis techniques and quantitative descriptive analysis techniques. Analysis technique descriptive qualitative used in process qualitative data to make improvements to LKS. Analysis technique descriptive quantitative used for process data systematically in the form of numbers and percentages related Respondents perceptions regarding the feasibility of learning media products in the form of math workbook to facilitate mathematical connection abilities.

Research result
Study This is study development (R&D) with objective for produce a LKS products that can facilitate ability connection mathematical student. As for the method learning to be entered to in this workbook is method learning REACT. For reach objective such, research This done using the ADDIE model. Following results research to be outlined based on the stages of the research model used:

Analysis Stage
Analysis step consists of two stages, that is analysis performance and needs analysis. Analysis performance aims to identify and clarify the basic problems encountered in learning. Performance analysis is carried out by detailing the content of teaching materials in the form of an outline. Problems found in research This is the available LKS not enough in accordance for facilitate ability connection mathematical students, so needed workbook development. Analysis need needed to determine abilities or competencies What what students need to learn to improve their creative thinking skills. Through stages this is known that LKS will be used by students of class VII junior high school who are approximately 13-15 years old, and the material will be developed is material set using learning models REACT (Relating, Experiencing, Applying, Cooperating and Transferring).

Design Stage
In step planning (design) prepared LKS and RPP (Draft learning) based method REACT on the material tree set. As for the steps on stage planning This namely: Determining the title of the LKS to be compiled, preparing source books and other reference books, identifying basic competencies, and designing appropriate forms of learning activities, identifying indicators of competency achievement and designing the form and type of assessment to be presented, designing the format for writing LKS.
One element important in making of this workbook is cover. In making this LKS consists on front cover and back cover. The front cover contains the title of the teaching material, a graphic image showing one method determine completion system linear equation two variable that is method chart thus

indicating that the LKS contains set material Relating, Experiencing, Applying, Cooperating and Transferring, concentration of teaching materials for class VIII junior high school semester I, and the identity of each LKS holder (name, class, and origin school). The design is fully made colors that are adjusted between one color and another with the aim of making it attractive to students.

Development Stage
After designing the product, then the product in the form of math workbook developed is validated by the validator namely learning material experts and experts technology education use questionnaire. The developed LKS validation aims to see whether the developed LKS is feasible or not to be tested. The results of the validation of learning material experts on REACT-based Mathematics LKS can be seen in the following table:

Table 3: Validity Results by Material Experts Learning

S. No	LKS Validity Variable	Validity Value	Criteria
1	Didactic Terms	90.37%	Very valid
2	Construction Terms	91.25%	Very valid
3	REACT technique	86.67%	Very valid
Overall Ideal Percentage		90.22 %	Very valid

Based on Table 3, the LKS assessment by learning material experts was stated to be very valid with an average validity value of 90.22%.
The results of the validation of educational technology experts on REACT-based Mathematics LKS can be seen in the following table:

Table 4: Validity Results by Educational Technologists

S. No	LKS Validity Assessment Indicators	Validity Value	Criteria
1	Use of letters and writing	98.57%	Very valid
2	Workbook Design	92.5 %	Very valid
3	Image use	93.33%	Very valid
4	LKS looks attractive	95%	Very valid
Overall Ideal Percentage		95.6%	Very Valid

Based on Table 4. the assessment of LKS by educational technologists is included in the valid category with an average validity value of 97.5%, then comments and suggestions are used as material for improving the developed LKS.
As for the results the validity of this LKS in a manner whole that is combined from the results of the validation of technology experts and the results of validation of learning material experts can be seen in the following table:

Table 5: Validity Results kindly Whole

S. No	LKS Validity Assessment Indicators	Validity Value	Criteria
1	Educational Technologist	95.6%	Very valid
2	Learning Materials Expert	90,22%	Very Valid
Average		93.4% _	Very Valid

Based on Table 5. Overall, the mathematics workbooks developed are stated to be very valid with an average validity value of 93,4%. However, comments and suggestions from each expert will be used as material for improving the developed LKS.

Implementation Stage

At stage This will practicality test and effectiveness test on the LKS that will be carried out developed. After math LKS based on Relating, Experiencing, Applying, Cooperating and Transferring model validated by the validator, workbooks tested for now practicality his. First, the LKS is tested to group small totaling 7 students. After being tested on small groups and receiving criticism and input from small groups, workbooks based on the Relating, Experiencing, Applying, Cooperating and Transferring model. This was first revised before being tested on large groups. The following are the results of small group trials:

Table 6: Analysis Results Response Student Small Group

S. No	LKS Practical Variables	Practical Value	Criteria
1	Student Interests and LKS Views	93.88%	Very Practical
2	Process of Use	95.71%	Very Practical
3	Concept Understanding	98.10%	Very Practical
4	Time	94.29%	Very Practical
5	Evaluation	94.29%	Very Practical
	Overall Ideal Percentage	95.43 %	Very Practical

Based on Table 6, it is clear that the practicality percentage of the small group is in the very practical category with an average practicality value 95.43%.

Next, done group trials large on 29 students who implemented meeting 4 times. After learning to use math LKS based on Relating, Experiencing, Applying, Cooperating and Transferring models and filling out assessments in the form of student response questionnaires which were carried out to assess the practicality of workbooks based on the Relating, Experiencing, Applying, Cooperating, and Transferring model practical data obtained as following:

Table 8: Analysis Results Response Student Group Big

S. No	LKS Practical Variables	Practical Value	Criteria
1	Student Interests and LKS Views	97.93%	Very Practical
2	Process of Use	96.67%	Very Practical
3	Concept Understanding	96.55%	Very Practical
4	Time	96.09%	Very Practical
5	Evaluation	99.31%	Very Practical
	Overall Ideal Percentage	97.42 %	Very Practical

Based on Table 8. the practicality percentage of the large group is included in the very practical category with an average practicality score of 97.42%.

After test practicality, researchers conducted an analysis of aspects of effectiveness LKS based on Relating, Experiencing, Applying, Cooperating and Transferring model by comparing the posttest scores of the experimental class and the control class. For know difference ability connection mathematical student before and after using LKS based REACT, then normality and homogeneity tests were carried out posttest. Following normality and homogeneity test results posttest on research this:

Table 9: Posttest Score Normality Test Results

Class	χ^2_{count}	χ^2_{table}	Criteria
Experiment	2,3467	11,07	Normal
Control	4,312	11,07	Normal

Table 10: Posttest Score Homogeneity Test Results

F_{count}	dk_{up}	dk_{down}	F_{table}	Criteria
1,50	28	24	1,95	Homogeneous

After the normality test and homogeneity test, the data is posttest the results of the study have a normal and homogeneous distribution. Because the posttest data is normal and homogeneous, the difference test uses the t test as follows:

$$t_{hitung} = \frac{M_x - M_y}{\sqrt{\left(\frac{SD_x}{\sqrt{n-1}}\right)^2 + \left(\frac{SD_y}{\sqrt{n-1}}\right)^2}}$$

Results t test posttest understanding of mathematical concepts student can seen on table following:

Table 11: Results Posttest score T test

t_{count}	t_{tabel}	Information
2,07	2,01	There is a difference

So that based on the test results obtained that there is a difference in the ability of mathematical connections between class VII A as an experimental class that applies the REACT model and class VII B as a control class that applies conventional learning.

Evaluation Stage

The evaluation stage is carried out after conducting validation and field trials. Researchers have carried out an evaluation of the math LKS which was developed based on suggestions from a team of experts and students. There is a number of repairs made in LKS- based development REACT these, including: making paragraphs and writing what is the name activities in the table of contents, improvement question more leads to ability connection and display again process model REACT on LKS, consistency writing, as well diagrams are noted again so no happen meaning error.

Discussion

Workbook Students (LKS) developed in study This load material set use method REACT (Relating, Experiencing, Applying, Cooperating and Transferring). Inside learning with the REACT model there are five concepts that must used during the learning process, namely: (1) Relating that is associating new concepts that will be learned with concepts that have been taught, other subjects, as well as with students' daily lives. (2) Experiencing ie student in build something The concepts he learns will be based on the experiences that have occurred in the class. (3) Applying that is students can apply or apply the concepts that have been found or that have been learned in life every day. (4) Cooperating is learning in mutual context share, respond, and communicate with fellow his friend. (5) Transferring ie use knowledge in A context new or situation new something things resolved/resolved in class.

Learning model existing REACT in this workbook that is form illustrations and questions, as in the picture following this:

Fig 2: Relating and Experiencing

Fig 3: Applying

Fig 4: Cooperating

Fig 5: Transferring

Validity

Results of expert data analysis material learning showing that LKS is based on Relating, Experiencing, Applying, Cooperating and Transferring model developed and has validated by the validator gets a very valid category with an ideal percentage of 90.22%. As for validity tested based on a

number of aspects namely: aspect didactic, aspect construction material, and aspect Relating, Experiencing, Applying, Cooperating and Transferring. Based on aspect LKS didactic enter in very valid category with percentage 90.37% with indicator: coverage material in the current curriculum support achievement competence as well as in accordance with indicator learning, emphasis on the process for find concept, as well exercise question in LKS can measure achievement competency. Based on aspect construction LKS material included very valid category with percentage of 91.25% with indicator: the language used in accordance with level development students, material with title and material tree served with simple and clear, there is enough space on the LKS for student write or describe something, completeness LKS content, and objectives clear study as well as useful. Based on the REACT technique obtained that this LKS including very valid category with indicator load phases learning use method REACT with percentage of 86.67%.

The results of the validity data analysis of educational technology experts show that the REACT model-based workbook developed based on technical requirements is in the valid category with an ideal percentage of 95.6% with indicator: usage letters and writing, LKS design, use pictures, as well LKS registration. So, LKS based REACT this declared valid and can made as teaching materials.

Practicality
Small group practicality data on 7 students shows that the developed REACT model-based workbooks get a very practical category with an ideal percentage of 95.43 %. As for the results this obtained through multiple test indicators, namely: the appearance of an attractive LKS interest student for use it, use it more practical and possible increase activity Study students, the REACT model on this LKS can increase ability connection mathematical students, time enough LKS work, practice available questions can assist the evaluation process ability connection mathematical shiva. Thus, this LKS stated practical and possible tested try it on more groups big. As for the results practicality data analysis in groups large on 29 students tested using the same indicator there is testing previously showing that the developed REACT model-based LKS get very practical category with percentage 90% ideal. So, LKS based REACT this has worthy and stated practical so that can made as a teaching materials.

Effectiveness
Ability test data analysis connection mathematician students obtained that before being given workbooks that were developed respectively it was found that the experimental class and the control class had homogeneous and normal data and there was no significant difference in students' conceptual understanding abilities obtained from the student pretest results.

Then it was continued with research where the experimental class was given math workbooks based on Relating, Experiencing, Applying, Cooperating, and Transferring. While the control class only conventional learning. After the learning process is complete, the test is carried out again by giving students in the experimental class and control class posttest questions then tested again. The results show that the class still has normal and homogeneous data results, but it is known that there are significant differences in students' mathematical connection abilities.

Based on these data it can be concluded that the mathematics module is based on Relating, Experiencing, Applying, Cooperating and Transferring that has been developed by researchers has an impact on connection capabilities student mathematics or in other words, effective for use in facilitating mathematical connection abilities for students.

Conclusion
Based on results research that has outlined can concluded that: (1) developing student workbooks (LKS) based on Relating, Experiencing, Applying, Cooperating and Transferring on set material is stated to be very valid, (2) developing student workbooks (LKS) based on Relating, Experiencing, Applying, Cooperating and Transferring on set material is included in the very practical category in small group trials and the practical category in large group trials, (3) developing student workbooks (LKS) based on Relating, Experiencing, Applying, Cooperating and Transferring on set material is declared effective. With thereby LKS developed this can made as teaching materials for facilitate enhancement ability connection mathematical student.

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