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**The 9th International Conference
on Educational Technology of Adi Buana**

Future Education: Welcoming the Era of Exponential

CONFERENCE PROCEEDINGS

**Graduate Program
University of PGRI Adi Buana Surabaya**
*Best Western Papilio Hotel Surabaya, Indonesia
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DEVELOPMENT OF SCIENTIFIC LEARNING DEVICES TO IMPROVE SKILLS OF SCIENCE PROCESS

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ABSTRACT

This research consists of two purposes: general purpose and special purpose. The common goal is to develop a Cooperative Learning based learning tool that can be used to improve the science process skills of junior high school students. While the specific objectives are: a) Describe the validity of learning tools based on Cooperative Learning developed in terms of content aspects, formats, and language. B) Describe the practicality of learning tools based on Cooperative Learning developed in terms of aspects of the implementation of RPP and c). Describe the effectiveness of learning tools based on Cooperative Learning developed in terms of some aspects of science process skills and student responses. Development is done using 4D model consisting of three stages of the process that is define, design, and develop. This type of research is one group pre test post test. Data collection is done through validation, observation, test and questionnaire. The analysis was conducted using qualitative and quantitative descriptive. From the research result data obtained that: validity of RPP 3.50 valid category with match equal to 98,97%, validation of student textbook 3,66 very valid and percentage of match 95,89%; Validity of student activity sheet 3,73 and 96,39% match; Validity of knowledge aspect test 3,78 and 95,0% match, validity test of skill aspect of science process 3,65 and match rate 91,43%. From the result of data analysis, the learning completeness level is high and able to surpass the KKM that has been established by the school that is equal to 85,16 for knowledge and 86,94 for pregnancy of science process. So it can be concluded that the learning device IPA subject matter sense and optical tools using cooperative learning model has a level of quality and good effectiveness to improve students' science process skills.

Keywords: *Learning Device Development, Cooperative Learning Model, Skill of Science Process.*

INTRODUCTION

The results of international studies conducted by Trends in International Mathematics and Science Study (TIMSS) indicate that the achievement of Indonesian students in learning Science is ranked 44th of 47 countries participating. While the analysis of PISA 2015 results states that of the 6 level capabilities formulated in the PISA study, the majority of Indonesian students are only able to master science lessons up to level 3 alone, while other countries involved in this study have been able to reach level 4, 5, and 6. This shows that the quality of education in Indonesia is mainly in terms of mastery of the concept of lessons is still relatively low compared with other countries in the world. Facts faced by researchers in the field is still obtained still a lot of students who must follow remedi learning. Some of the above encourage researchers to develop learning tools that are expected to be able to improve the skills of students' science process skills especially on the subject of the sense of sight and optical devices. Learning tools designed consist of learning implementation plans, student textbooks, student activity sheets and evaluation tools based on cooperative learning. Learning where students will be exposed to situations of their involvement with concepts and principles as well as involvement among students in building an understanding of the knowledge learned. So it is expected that this learning model can improve students' science process skills.

METHOD

Device Development Phase

The development of learning tools developed by researchers using the 4D development model is the definition stage, the design stage, and stop at the development stage. For the fourth stage, the dissemination phase is not performed. (2) Student analysis, (3) task analysis, (4) concept analysis and (5) formulation of learning objectives. The defining stage is done with the aim of establishing the learning conditions. At this stage it is thought that on the subject of the sense of sight and optical tools will be more interesting if delivered cooperatively where students can work together and exchange information. At this stage is known stage of thinking students viewed from the level of his age. Where in grade VIII students who have an age range between 13-15 years is at the stage of formal operation (abstract and pure symbolic thought).

In the design stage, prototype (draft I) is made of learning plan which consists of learning implementation plan (RPP), student textbook (BAS), Student Activity Sheet (LKS) and Scientific Skills Assessment Instrument. This draft is then validated by two validators consisting of validation of media design and content validation. The validation results are further revised and become Draft II. Draft II was tested in experiments 1 and 2 to obtain the final design of learning tools developed.

Product Test Stage

This study uses The One-Group Pretest-Posttest Design. The first step is to provide pretest in the class that will be studied that is class VIII-J. Furthermore, this class is given treatment in the form of learning learning using cooperative learning to improve students' science process skills for four times face to face and end with the final test (posttest).

Test Subject

The test subjects in this study are students of class VIII-J SMP Al Hikmah Surabaya academic year 2016-2017.

DATA ANALYSIS

Device Validity Data Analysis

Analysis of device validation data conducted in this research is qualitative descriptive that refers to the feasibility assessment of learning devices from two validators. The analysis is done by calculating the average rating by both validator for each developed device.

Table 2.1 Description of Device Validation Score

| Validation Score Average | Category | Description |
|--------------------------|-----------------|---|
| $0 \leq SV \leq 1,59$ | InValid (TV) | Not in use and still require consultation |
| $1,60 \leq SV \leq 2,59$ | Less Valid (KV) | Can be used with many revisions |
| $2,60 \leq SV \leq 3,59$ | Valid (V) | Can be used with a few revisions |
| $3,60 \leq SV \leq 4,00$ | Very Valid (SV) | Can be used without revision |

Description: SV = Validation Score

Data Analysis of the Practicality of Learning Devices

Data on teachers' ability in managing learning are analyzed by calculating average data of each aspect and phase in Cooperative Learning model using learning implementation criteria in the table below. Assessment criteria for the implementation of learning are categorized as follows.

Table 2.2 Criteria for the Implementation of Learning (Riduwan, 2012: 15)

| Score | Criteria |
|-------------|-----------|
| 0,00 – 1,49 | Less |
| 1,50 – 2,59 | Enough |
| 2,60 – 3,49 | Good |
| 3,50 – 4,00 | Very Good |

Percentage of the implementation of the learning steps is calculated using the following formula.

$$P = \frac{\sum A}{\sum N} \times 100\%$$

Information:
 P = Percentage of implementation of RPP
 $\frac{\sum A}{\sum N}$ = Number of stages performed
 $\sum N$ = Total number of stages observed

Persentase keterlaksanaan setiap tahap pembelajaran menggunakan kriteria sebagai berikut:

5% - 24% : tidak terlaksana
 25% - 49% : pelaksanaan kurang
 50% - 74% : pelaksanaan baik

Aspect Analysis of the Effectiveness of Learning Devices

Analysis of the effectiveness of learning tools developed is supported in terms of student learning outcomes (aspects of knowledge and skills of the process of science). The value of numbers for knowledge and skills of the science process is 0-100 which is equivalent to the letter D - A. The following table of optimal achievement scores and predicate aspects of knowledge and skills of the science process used in this study.

Table 2.3 Criteria for Assessment of Knowledge and Skills of the Process of Science (Kemdikbud, 2015:43)

| Skor Optimum | Predikat | Kategori |
|--------------|----------|-------------|
| 86-100 | A | Sangat Baik |
| 71-85 | B | Baik |
| 56-70 | C | Cukup |
| ≤ 55 | D | Kurang |

Determination of a large increase in knowledge and skills of students' scientific processes individually, classically and thoroughly every aspect of knowledge and skills of the process of science then used gain score analysis <g>.

Table 2.4 Normalized N-Gain Criteria (Hake, 1999:1).

| Normalized N-Gain Criteria | Categories Gain |
|-----------------------------|-----------------|
| $< g > < 0,30$ | Low |
| $0,30 \leq < g > \leq 0,70$ | Medium |
| $< g > > 0,70$ | High |

RESULT AND DISCUSSION

Learning Tool Validation Results

Results and analysis of the Implementation Plan Validation

| No | Aspects of assesment score | V1 | V2 | Average score | Criteria | R(5) |
|--------------------|---|------|------|---------------|----------|--------|
| II FORMAT | | | | | | |
| 1 | Distribution of material according to time allocation | 4 | 4 | 4,00 | SV | 100,0 |
| 2 | Numbering system | 3 | 4 | 3,50 | V | 85,71 |
| 3 | Spatial setting / layout | 4 | 3 | 3,50 | V | 85,71 |
| 4 | The font type and size are appropriate | 4 | 4 | 4,00 | SV | 100,00 |
| average | | 3,75 | 3,75 | 3,75 | SV | 100,00 |
| III CONTENT | | | | | | |
| 1 | Write down core competencies | 3 | 4 | 3,5 | V | 85,71 |
| 2 | Write down basic competencies | 4 | 4 | 4 | SV | 100,00 |
| 3 | Write down the indicator | 3 | 4 | 3,5 | V | 85,71 |

| | | | | | | |
|-----|---|----------|------|------|----|--------|
| 4 | Write down the learning objectives | 4 | 3 | 3,5 | V | 85,71 |
| 5 | Accuracy between indicators with KD | 4 | 3 | 3,5 | V | 85,71 |
| 6 | Appropriateness between indicators with learning objectives | 3 | 4 | 3,5 | V | 85,71 |
| 7 | Truth content / material | 3 | 4 | 3,5 | V | 85,71 |
| 8 | Grouped in logical parts | 3 | 4 | 3,5 | V | 85,71 |
| 9 | Compliance with the competency standards of the 2013 curriculum | 4 | 4 | 4 | SV | 100,00 |
| | The selection of strategies, approaches, methods, and means of learning are done appropriately, enabling students to study science literacy | 4 | 4 | 4 | SV | 100,00 |
| | Teacher activities and student activities are formulated clearly and operationally, making them easy to implement in the classroom learning process (introduction, core activities and cover) | 4 | 4 | 4 | SV | 100,00 |
| | Compatibility with time allocation used | 4 | 4 | 4 | SV | 100,00 |
| | The steps in the activities are in accordance with the Cooperative Learning model | 4 | 4 | 4 | SV | 100,00 |
| | Average | 3,62 | 3,85 | 3,73 | SV | 96,91 |
| III | LANGUAGE | | | | | |
| 1 | In accordance with easy-to-understand Indonesian rules | 4 | 4 | 4 | SV | 100,00 |
| 2 | Accuracy of sentence structure | 3 | 3 | 3 | V | 100,00 |
| | average | 3,50 | 3,50 | 3,50 | V | 100,00 |
| | % Percentage of Agreement | 98,97 | | | | |
| | category | Reliabel | | | | |

Student Textbook Validation Analysis

The average score of the four validated aspects of the textbook of students is 3.66 with the category so valid that the developed and revised textbook can be used as a learning resource in the learning activities. The percentage between the two validators on this Bas is 95.89% which means fit.

Results and analysis of Student Activity Sheet Validation

Validation results Student activity sheet (LKS) has been validated by the two validators and obtained the percentage of match 96.39%. Valid aspects include aspects of formatting, language aspects, content aspects and question aspects. From these four aspects, the average score of 3.73 is obtained, which means it is very valid. So it can be concluded that after a little revision in accordance with the input and suggestion of the two validators then LKS developed can be used as a reference in carrying out experimental activities in learning.

Results and analysis of Assessment Tool Validation

Assessment of knowledge aspect obtained the average total score is 3.78 so included in the category is very valid and the percentage of match between the two validators 95.0% which means fit. The general assessment of this instrument is applicable with small revisions. So the knowledge scoring sheet that has been prepared by the researcher can be used as a test tool. While on science skill aspect aspect got the average total score is 3,65 so that included in category very valid and match 91,43% which means validation to validator validation. The general assessment of this instrument is applicable with small revisions. So the science process skill assessment sheets that have been prepared by the researcher can be used as a test tool.

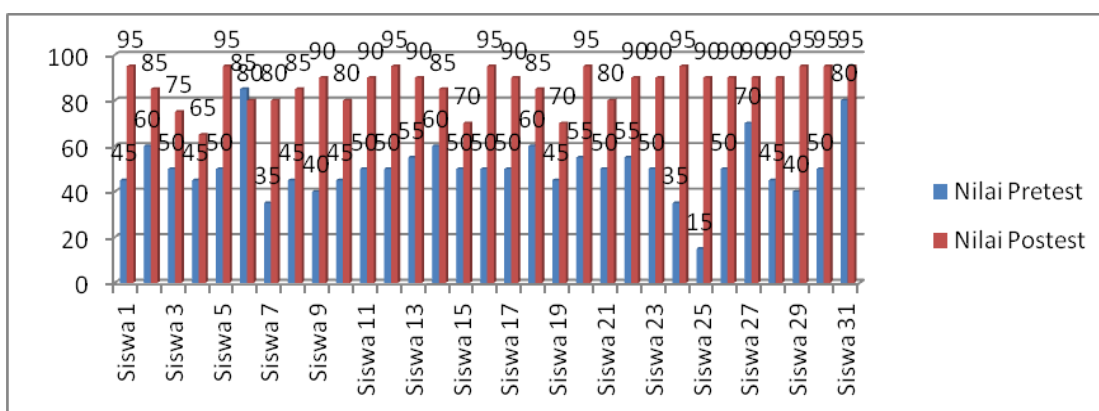
Results and analysis of the implementation of RPP

Analysis of the practicality of learning devices conducted by researchers in this development is the practicality of application of RPP developed. From result of analysis of practical learning device data obtained that RPP1, RPP2, RPP3, and RPP4 got value and percentage of consecutive respectively are 3,583 and 96,32%; 3,5 and 95,23%; 3,583 and 98,72% and 3,417 and 96,15% respectively so that the average of RPP is 3,52 with 97,80% match rate. For the stages in the RPP obtained data that for preliminary activities into the category of good, sufficient core activities and activities cover good category. So that the RPP that has been prepared can be used as a guideline for the implementation of learning in the classroom.

Data and analysis of the Effectiveness of Learning

Outcomes and analysis of the Aspects of Knowledge Tests and the Aspects of Process Skills of Science

From the analysis of data that can be seen in the table can be concluded that there is a high increase of learning outcomes both on aspects of knowledge and skills aspects of the science process using the tools developed.



Student Response

The level of effectiveness of learning tools developed also in review of the response of students during the learning process. From the analysis of data obtained in obtaining students response 75.66% which shows a positive response to the implementation of learning by using a device developed by researchers

CONCLUSION

Based on data analysis of research results obtained information about the formulation of the problem in this study as follows :

Validity of learning tools based on Cooperative Learning developed according to content, format and language:

RPP

From the results of the assessment of the two validators obtained an average valuation of 3.50 which means entered in the category valid. The strength of the developed RPP lay in its format and the weakness of language use.

Student Textbook

In the textbook students obtained a value of 3.66 which means very valid and has the power on the content and presentation of the material is weakness lies in the language side.

Student Worksheet

In the LKS developed in this study obtained 3.73 with the strength of this lks lies on the side of the language. While the weakness in the content.

Assessment Tool

For the appraisal tool on the knowledge test, the value of 3.78 was obtained on the content and on the science skills test 3.65.

The practicality of application of learning tools based on Cooperative Learning:

Implementation of learning devices from the data analysis obtained value 3.52. RPP developed in preliminary activities and closing activities of both categories whereas in the core activities enough.

The effectiveness of application of learning tools based on Cooperative Learning:

The result of the students' knowledge test using the developed test tools obtained the average score of 85.16 science skill test obtained the mean value 86,94. With 75.66% of students showed a positive response during learning. Based on the results mentioned above, indicating that the learning device can be applied to science learning in SMP Al Hikmah Surabaya.

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