

The Development of Discovery Learning Based Student' Worksheet on Topic Quantity, Measurements and Vectors

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Abstract - This research is in the background of the author's concerns about the teaching and learning process in schools, educators are more dominant than students, shown by the way used by educators when the teaching and learning process still uses the lecture method by giving percentages and practice questions to students and students do not experiment at all in the teaching and learning process so that students have not been very active in building concepts in learning that has taken place. In learning curriculum 2013 students are required to be more active in building concepts through scientific approaches such as analyzing, associating, collecting information, questioning, observing and telling about what they have found in the teaching and learning process carried out between educators and students. This type of research uses research methods of development or Research and Development (R&D). The development research method is a research method used to produce a certain product, and test the effectiveness of the product. The results showed that the feasibility of LKPD based on discovery learning on the material of the measurement and vector quantity that had been developed by researchers according to the assessment of media experts as a whole got a score of 71% in the feasible criteria. Meanwhile, based on the assessment of experts, the material as a whole got a score of 90% in the criteria is very feasible while the response of students to LKPD based on discovery learning on the material of the measurement and vector quantities that have been developed as a whole gets a score of 89% included in the criteria is very interesting.

Keywords: LKPD; Discovery Learning

INTRODUCTION

Education is the space most needed to improve the quality of human resources. According to Law No. 20 of 2003 article 3 concerning the National Education System, the purpose of national education is to develop the potential of students to become human beings who have faith and piety in God Almighty, have a noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens (Dediknas, 2008).

In the teaching and learning process, educators must be able to encourage students to construct knowledge through the development of patterns of thinking skills in Learning activities, such as in physics learning.

Physics is one of the important subjects in improving science and

technology. Aspects of physics include products, processes, and attitudes. From the aspect of physics products, it looks at the knowledge in the form of facts, theories, principles and concepts, while in terms of the physics process, it is scientific work that helps students in finding concepts, experimenting, discussing and involving students in the teaching and learning process and finally, the attitude aspect, namely the behavior of a student in everyday life (Sary and Harjono, 2016).

This opinion is in accordance with the learning of the 2013 Curriculum which is designed so that students are more active in building concepts through scientific approaches such as analyzing, associating, collecting information, questioning, observing and knowing about what they have found in the teaching and learning

process carried out between educators and students

To form quality and characterful human resources, it is necessary to provide opportunities for students to find facts and build knowledge concepts through tools that can provide the ability to maximize the goals of the physics teaching and learning process, one of which is teaching materials.

This teaching material is needed in the learning system, one of which is the student worksheet (LKPD). This student worksheet (LKPD) is a printed teaching material in the form of sheets of paper containing material, summaries, and instructions for the implementation of learning tasks that must be carried out, both theory and practice which refers to the basic competencies that must be achieved in learning

This student worksheet (LKPD) is usually used to open opportunities for students so that students are more active in the learning process carried out between students and educators in realizing physics goals properly (Febriani, 2017)

Based on observations at MA NW SURALAGA that educators have used student worksheets (LKPD) to provide understanding to students, but in its implementation, student understanding tends to be low because the student worksheets (LKPD) still use the conventional model and the student worksheets (LKPD) presented by the teacher are less attractive so that students are not interested in working on the student worksheets (LKPD).

One way to provide learning vehicles for students is by using a learning model. A learning model that is effective in suppressing students in learning and finding their own concepts, namely the discovery learning learning model

Based on facts in the field of observation results in MA NW Suralaga, the role of educators is more dominant than that

of students, it is shown by the way used by educators when the teaching and learning process still uses the lecture method by providing percentages and practice questions to students and students do not experiment at all in the teaching and learning process so that students have not been very active in building concepts in learning that have taken place

In the discovery learning model itself, teachers are required to be more creative in creating situations that make students learn actively and find their own knowledge. Meanwhile, in another view, discovery learning is a learning process whose delivery of material is not complete, because the discovery learning model requires students to be actively involved in the learning process and find for themselves a learning concept. (Cintia, et al., 2018). So discovery learning is a model that leads students to find concepts through various information or data obtained through observation or experimentation

Based on research conducted by Pratiwi and Yulkifli in the Journal "Skills Improvement Students Use Worksheets Based On Discovery learning Models On Fluid Materials" that there is an influence on the use of LKPD based on the discovery learning model on skill competence. This can be seen from the increase in skill competence when it has been given treatment and can be seen from the average scores that are quite different between the experimental class and the control class with scores of 78.62 and 70.10, respectively. (Pratiwi, 2019).

Based on the same research conducted by Nella Nurul Adilla in the title "Development of Discovery Learning-Based LKPD on Hydrostatic Pressure Material Class XI Man 4 Aceh Besar" it can be concluded that the development of this discovery learning-based LKPD in material experts can be categorized as very feasible

by 80%, media experts deserve 78%, and student responses of 82% so that it can be said to be very interested in learning to use student worksheets (LKPD) based on discovery learning (Adilla,2019). Seeing this, researchers are interested in developing LKPD based on discovery learning.

RESEARCH METHODS

This research uses the research method of development or Research and Development (R&D). Research and development methods are research methods used to produce a particular product, and test the effectiveness of that product.

The research and development carried out by researchers is to develop products in the form of LKPD based on discovery learning. This type of research and development is considered the most suitable for use by researchers in developing LKPD products on measurement magnitude materials and vectors to test the effectiveness of products

The study was conducted at MA NW Suralaga from November to December 2021. The steps used by researchers include:

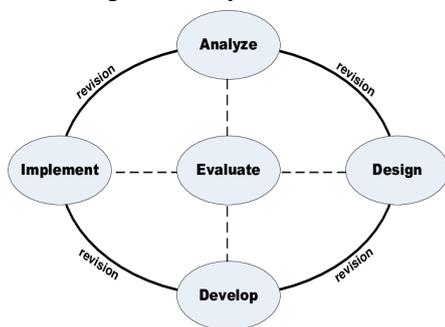


Figure 1. Data Analysis research development procedure

The analysis used in this researcher is to use qualitative, namely continuous data collection through observation, can be obtained through teacher interviews and documentation so that the data collected is more and more data analysis in this study. Analyzing data is a very critical step in conducting research. After the results of the

data analysis can be used as an initial stage in the research to improve the learner worksheet procedure (LKPD) based on discovery learning developed.

Validation Questionnaire

The final value of an item is the percentage of the average value per indicator. From the calculation of the score of each statement, the percentage of answers from the total number of respondents is sought using the formula (Ardian Asyahri, 2016):

$$P = \frac{\sum X}{\sum Xi} = 100 \% \quad (1)$$

Information:

Q :Percentage

$\sum X$: Number of respondents' answers in one item

$\sum Xi$: The number of ideal values in the item

Then find the percentage of validation criteria. The validation criteria used can be seen in the table below.

Table 1. Eligibility interpretation criteria

interval	Criteria
0%-25%	Very Unworthy Very Unworthy
26%-50%	Not Worth It
51%-75%	proper
75%-100%	Very Worthy Very Worthy

a) Material Expert Validation

Before using the research instrument, the researcher first validates the instrument by a material expert ..

Here the researcher has collected tips and suggestions that have been given by material validation experts which will later be used as revisions or improvements by researchers in making the developed LKPD.

Table 2. Indicators of Assessment by Material Experts

No.	Indicator
Content Feasibility Aspect	
1.	The suitability of the material with KD
2.	Material accuracy _
3.	Material up- to -date .
4.	Encourage curiosity _
Language Aspect	
5.	straightforward
6.	Communicative
7.	Dialogic and Intractive
8.	Conformity with the development of learners
9.	Conformity with the rules of the language

b) *Media Expert Validation*

Before the research instrument was used, the instrument was validated by a media expert, after that the researcher collected some criticisms and suggestions that had been given by the validation media expert which would later be used as a revision or improvement by the researcher in making this LKPD media .

Table 3. Assessment Indicators By Media Experts

No.	Indicator
LKPD Cover Design (Cover)	
1.	The letters used are attractive and easy to read
2.	Use the right combination of letters
LKPD content design	
3.	Layout consistency. _ _ _
4.	The illustrations and descriptions are clear.
5.	Placement of titles, subtitles, illustrations and picture descriptions can increase understanding
6.	The typeface used is appropriate
7.	Subtitles are clear, consistent and p ropersional
8.	Able to express the meaning or meaning of each o object
9.	The image displayed is accurate
10.	Creative and dynamic .

c) *Student Response*

and Student Response Questionnaire using a Likert scale with the following information.

- a. The answer "Strongly Agree (SS) is given a score of 4"
- b. The answer "Agree" (S) is given a score of 3
- c. The answer "Disagree (TS) is given a score of 2"
- d. the answer "Strongly Disagree" (STS) is given a score of 1

From the results of the calculation of the score for each statement, the presentation of answers from the total number of respondents is sought by using the formula:

$$P = \frac{\sum X}{\sum Xi} \equiv 100 \% \quad (2)$$

Information:

P = Percentage

ΣX= Number of respondents' answers in one item

Σxi= The number of ideal values in the item

The determination of the questionnaire score interpretation criteria can be seen in the following table:

Table 4. Attractive Interpretation Criteria

Interval	Criteria
0%-25%	Very Unattractive
26%-50%	Not attractive
51%-75%	Interesting
75%-100%	Very interesting

(Noziopra and Arizal, 2013)

Based on the table above, it shows that the higher the value of interpretation, the higher the attractiveness of learning media for student worksheets (LKPD).

The following researchers have collected student opinions which will later be revised or improved by researchers in making discovery learning-based worksheets.

Table 5. Student Party Indicator

No.	Statement
1	The student activity sheet (LKPD) based on discovery learning uses easy-to-understand language.
2	Student worksheets (LKPD) based on discovery learning use sentences that do not cause multiple meanings.
3	The activity instructions in discovery learning-based worksheets are clear, making it easier for me to carry out all activities.
4	The choice of font, size and space used makes it easier for me to read discovery learning-based worksheets .
5	At the beginning of learning using student worksheets (LKPD) based on discovery learning , there was something interesting for me.
6	The style of presenting this discovery learning-based worksheet is not boring
7	Every page or sentence contained in the discovery learning-based worksheet is easy for me to understand
8	In this lesson I often state questions in the form of pictures, sketches, or diagrams.
9	A variety of activities, assignments, practice questions, illustrations and others help me to develop my physics skills.
10	When studying I always re-examine the results of the work I get and make conclusions according to the problems asked.
11	From every activity in this discovery learning-based worksheet , I can conclude and take important ideas about the material for measurement and vector quantities.
12	I can relate the contents of this discovery learning-based worksheet to things I have seen, done, or thought about in my daily life.
13	I can gain knowledge by participating in a series of activities in the student worksheets (LKPD) based on discovery learning
14	I am able to make physics models from questions in the form of descriptions and story questions
15	While I am learning to use this worksheet, I believe that I can study the content well

No.	Statement
16	After studying measurement and vector quantities using this discovery learning-based worksheet , I believe that I will be successful in answering the questions.
17	The contents of this discovery learning-based worksheet are very useful for me.
18	By using LKPD Based on this discovery learning, I easily understand the material
19	I like to study physics, especially the material of measurement and vector quantities using this discovery learning-based worksheet .
20	The contents of this discovery learning-based worksheet are in accordance with my interests.

RESULTS AND DISCUSSION

Results

The assessment of the validity and feasibility of the LKPD was carried out by 4 lecturers and 1 physics teacher and 7 students. Media experts assessed the development of student worksheets in two points, namely the cover design of the LKPD (cover), and the design of the contents of the LKPD. Material experts assess the development of LKPD in two aspects , namely the aspect of content feasibility and linguistic aspects. The data from the LKPD assessment includes data in the form of scores and then converted into four categories, namely very feasible (SL), feasible (L), less feasible (KL), and not feasible (TL). The scores obtained are also processed into a feasibility index for the eligibility criteria.

a) Media expert assessment

The results of the LKPD assessment by media experts can be seen in the following graph.

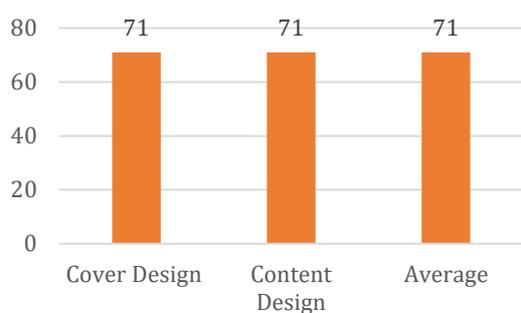


Figure 1. Media Expert Rating

From the diagram above, it shows that the index is equally between the LKPD cover design aspects (cover) with a feasibility index of 71% with proper criteria. While in the aspect of the design of the contents of the LKPD, it gets a feasibility index of 71%. Based on the results of the analysis of the media expert's assessment of the LKPD on the media aspect as a whole, the average value per aspect is 71% with a decent category, so that it can be used in the learning process. Thus, the media expert's assessment of the feasibility of discovery learning-based worksheets developed by the researchers showed that the student worksheets were suitable for use or could be used with revisions. This is in accordance

with the eligibility criteria for the participant worksheet if the student worksheet obtained with appropriate criteria if all the items in the elements assessed are appropriate and even though there are slight deficiencies and the need for justification with the student worksheet product or revision, it can still be used as student worksheets.

b) Material expert assessment

The following shows the results of the LKPD assessment on the material aspects assessed by the mystery expert.

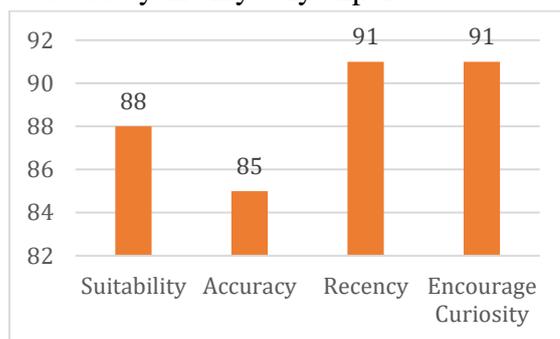


Figure 2. Expert Assessment of Content Feasibility Aspects

While the LKPD assessment on the linguistic aspect can be seen in the following graph.

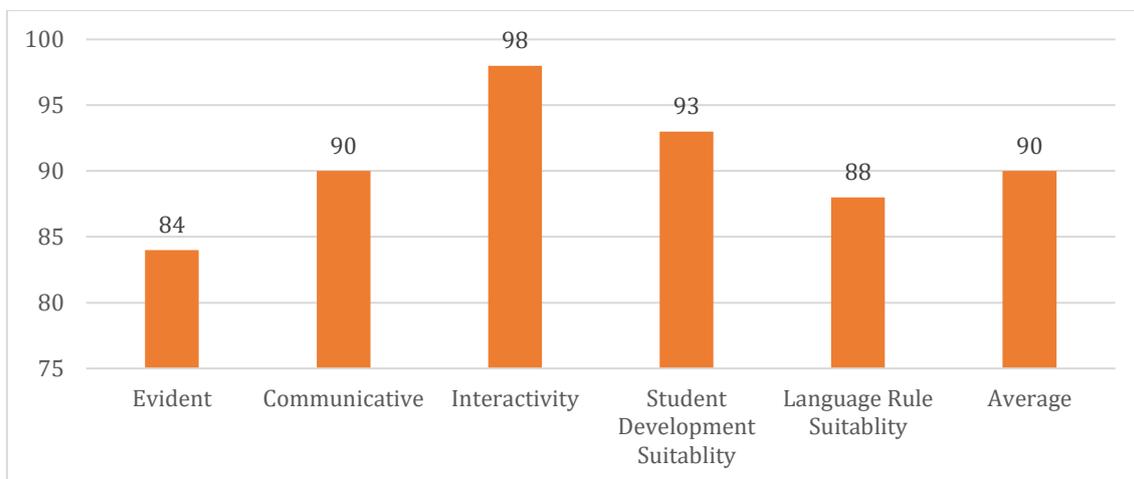


Figure 3. Language Aspect

Based on the results of the analysis of material expert assessments regarding discovery learning-based worksheets, the overall score per aspect is 90% with a very decent category. It can be seen from the

diagram above, that the content feasibility aspect gets a feasibility index of 90% with very feasible criteria and linguistic aspects get a feasibility index of 90% with very decent criteria.

Thus, the material expert's assessment of the feasibility of the LKPD developed by the researcher shows that the student worksheets are very feasible to use. This is in accordance with the eligibility criteria for student worksheets, if student worksheets are obtained with appropriate criteria if all items in the elements assessed are appropriate and although there are slight deficiencies and need for justification with student worksheet products or revisions, they can still be used as a student worksheet.

c) Student response

After going through several stages of validation of various aspects of the discovery learning-based LKPD, the researchers collected data on student responses to the developed LKPD.

Based on the results of data analysis on LKPD obtained from the responses of students as a whole, they get a feasibility index with a score of 89% with a very interesting category.

Discussion

The success of increasing creative thinking skills and learning outcomes is due to the application of the discovery learning model which is carried out in accordance with the syntax. According to Wahyudi & Siswanti (2019), *discovery learning* is a learning process in which students are not presented with lessons in their final form, but students are expected to organize themselves, discovery learning places more emphasis on discovering previously unknown concepts or principles (Cintia, 2018). According to the researcher, discovery learning is a series of learning activities that involve students in active learning to find their own knowledge. By learning discovery, students can think analytically and try to solve their own problems.

This model applies students to reasoning and critical thinking so that they

are able to improve the results of student competency skills where the syntax of this discovery learning model applies steps of a scientific approach such as step 5 M which includes observing, asking questions, collecting information, analyzing data and communicating (Nadya Pratiwi, 2019)

Research and development in this study produces a product in the form of *discovery learning -based worksheets* on measurement and vector quantities. This research was developed using the Research and Development (R&D) method using the ADDIE model. The stages in this study only use 5 stages, namely *Analysis, Design, Development, Implementation, Evaluation:*

1) Analysis

The results of the analysis based on observations found that at MA NW Suralaga had used student worksheets in physics subjects. The school uses student worksheets but it is not based on *discovery learning*. The reason the educators did not develop student worksheets based on *discovery learning* in physics subjects was because there was not enough time to make LKPD in accordance with the 2013 *curriculum. Learning* to help teachers in the teaching and learning process.

2) Design

After the analysis stage, the next step is the design stage. The first stage of this design is the preparation of learning lesson plans, compiling research instruments and compiling LKPD systematics.

3) Development

The third stage, namely the development stage, this stage is the main stage in this research because at this stage it makes the product into a unified whole in accordance with the *discovery learning syntax* and validates by several experts, validation to obtain input, suggestions for improvement in order to perfecting the developed product so that the product has reached a worthy category to be tested on

respondents.

a. Media expert

Based on the results of validation by media experts with the first media expert, namely: Mrs. Rima Buana Prahastiwi, M.Pd and the second media expert, Mr. Ilham. Based on the results of the research score on the LKPD cover design aspect, it can be obtained as many as 71%. After going through a few improvements, media experts are of the opinion that in the LKPD cover design that has been developed the font used is quite attractive and easy to read, so that the LKPD cover design can be said to be "Decent". Meanwhile, based on the feasibility assessment by media experts on the design aspect of the LKPD content of 71%. After repair and the two experts are of the opinion that the consistency of the layout, image illustrations, title placement, and images displayed are good enough so that the average result obtained in this media expert validation is 71%, so it is included in the "Decent" category.

b. Material expert

Based on the results of the validation, the material was assessed by two physics lecturers at Uin Mataram, 1 physics teacher at MA NW Suralaga and 7 There are 10 students of physics at UIN Mataram in total and assessed from two aspects, namely:

1. Content feasibility aspect

on the aspect of content feasibility This is assessed from the suitability of the material with KD, material accuracy, material up-to-date and encouraging curiosity so that LKPD can be categorized as "Very Eligible". The feasibility assessment by material experts on the aspects of the suitability of the material with KD of 88%, material accuracy of 85%, material updating of 91%, and encouraging curiosity of 91%. So that the results of the average obtained in the validation of the material on the aspect of content feasibility by 89%, then it can be

categorized "Very Worthy".

2. Language Aspect

In this linguistic aspect, it is assessed from communicative, dialogical and interactive, compatibility with the development of students, and conformity with language rules. The assessment on the straightforward aspect is 84%, communicative is 90%, dialogue and interactive is 98%, the suitability of student development is 93%, and the conformity of language rules is 88%, so that the result of the average obtained in the validation of the linguistic aspect is 90%, then it can be categorized "Very Worthy". So the average between the content feasibility aspect and the linguistic aspect is 90%, so we can categorize it as "very feasible".

4) Implementation

The implementation phase was carried out on students by involving as many as 30 students at MA NW Suralaga class X and XI IPA. In the data collection process, it is done by dividing discovery learning-based worksheets to students to study first so that the results of data analysis obtained from student responses show that the overall score is 89% with a feasibility index which is very interesting.

5) Evaluation

Based on the results of the description above, it can be concluded that the student worksheets based on discovery learning that have been developed can be used or are suitable for use in the learning process.

CONCLUSION

Based on the results of research conducted by researchers, it can be concluded: 1). The feasibility of *discovery learning-based worksheets* on measurement and vector quantities that have been developed based on an assessment by media experts as a whole gets a score of 71% in the appropriate criteria. Meanwhile, based on

the assessment by material experts as a whole, the score is 90 % in very feasible criteria, 2). Student responses to discovery learning-based worksheets on measurement and vector quantities that have been developed as a whole get a score of 89% including very interesting criteria.

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