

8. Development of Students Worksheets Based on Discovery Learning in Thematic Learning for 4th Grader Elementary School

By Alben Ambarita

2 Development of Students Worksheets Based on Discovery Learning in Thematic Learning for 4th Grader Elementary School

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1 Abstract

This study aims to develop teaching materials in the form of students worksheet based on discovery learning in thematic learning of fourth grader elementary school. The type of research used is research and development (R & D) that refers to the theory of Borg & Gall. The population of this study is all fourth grade elementary school students in Langkapura sub-district. Sample were taken by using random sampling technique as many as 56 students of SD Negeri 2 Langkapura. Data were collected through questionnaires and test questions. Questionnaire is used to measure the feasibility of students worksheets and test questions to measure the improvement of student learning outcomes. The results showed that students worksheet based on discovery learning were developed feasible and effective for learning. This is proved from the results of the acquisition of questionnaires by experts and teachers who stated that the development products are feasible based on didactic, construction and technical requirements. As well as the results of the calculation of effectiveness tests that obtain an average gain value of 0.365 which proves that students worksheet based on discovery learning are effective in improving student learning outcomes.

Keywords: Student worksheets, Discovery learning, Learning outcomes

1. Introduction

Education is the 41st in factor that determines the quality of a nation. A nation can be said to be advanced, if education which is a means to create human resources (HR) has also progressed. Education is a conscious and planned effort to enliven the atmosphere of learning so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and the skills needed by themselves, the people of the nation and the state. 2

One of the government's efforts to improve the quality of education is through improving the quality of human resources. The teacher is 14th of the elements of the nation that has a strategic role in improving human resources. The teacher has a very important role in the implementation of the educational process and builds the character of the nation's children. Teachers must be able to plan and develop activities that are interesting, creative and dynamic so that the learning process becomes fun. 19

The 2013 curriculum (K13), a curriculum that is currently implemented by the government is one of the efforts made by the government in 19th improving the quality of human resources. K13 has the aim that students have ability qualifications that include attitudes, knowledge and skills. The learning process that we often see in schools has not used appropriate teaching materials and learning models, so students become less active and learning becomes less meaningful.

There are four learning models that are 5th oritized in the 2013 curriculum, one of which is a discovery learning model. According to Balim (2009: 2) discovery learning is a learning model that encourages students to arrive at a conclusion based on their own observations. Discovery learning model seeks to place the foundation and develop ways of thinking scientifically, students are placed as learning subjects, while teachers act as tutors and learning facilitators. 31st rrespondingly, Budiningsih (2010: 43) explains that the discovery learning model is understanding concepts and relationships through an intuitive process to finally arrive at a conclusion. Discovery learning models emphasize finding concepts or principles that were previously unknown.

Discovery learning will help students play an active role through information discovery so 2nd that students gain their own knowledge 5th observation or discussion in order to get more meaningful learning. In addition to the use of learning models, one of the supporting factors in the success of the learning process is the existence of teaching materials. The teaching materials can be in the form of textbooks, students worksheets, handouts, and so on. One of the teaching materials commonly used is student worksheets.

Lee (2014) said that student worksheets is a written teaching material, student worksheets can act as a medium from the teacher to lead students' attention and provide opportunities for students to study independently and the teacher has time to take care of students who need further assistance. In line with the above opinion, Majid (2014: 76) argues that student worksheets is a sheet of work that must be done by students. Student worksheets usually contains instructions for students to carry out activities and aims to guide students to active activities during the learning process. However, the student worksheets that has been circulating in the market

has not been in accordance with the demands of the latest curriculum so that what students need is not yet fully achieved.

The distribution of needs analysis questionnaires conducted on 3 teachers in fourth grade elementary school showed that 66.67% of teachers had used worksheets in learning. However, the student worksheets that have been used are still student worksheets from publishers, and 100% of teachers agree to develop an student worksheets that matches the needs of students and the provisions of K13.

Based on the description above, teachers are required to be able to design their own worksheets because teachers can better understand and understand what is needed by their students. The use of worksheets will facilitate the teacher in the learning process, and students will get the learning experience independently and be able to understand the tasks contained in the worksheet. Student worksheets usually contains instructions for students that aim to guide students to do active activities during the learning process.

According to Toman (2013: 174) student worksheets is one of the teaching methods that can be done individually or in group work and allows conceptual development. Whereas according to Celikler (2010) student worksheets defined as a basic tool that supports the steps of the process that are needed and helps students to understand knowledge and at the same time provide full participation of all classes in activities. Student worksheets is a guide in conducting investigations as well as one of the instructional learning resources which includes material, questions for practice and instructions for the implementation of tasks that students must do to understand the material learned and solve problems by referring to the competencies that must be achieved.

Illahi (2012: 33) says, that discovery is one of method that allows students to be directly involved in teaching and learning activities, so that they are able to use their mental processes to find a concept or theory that being studied. Through the use of student worksheets based on discovery learning, learning activities are expected to be more interesting and make students more active in teaching and learning activities.

In accordance with these problems, the purpose of this research and development is to develop student worksheets based on discovery learning in thematic learning with the theme of 8 My Places of Living b-theme 2 The uniqueness of the area in my residence fourth grade elementary school which is feasible and effective to improve student learning outcomes.

2. Method

2.1 Types of Research and Procedures

This research is Research and Development (R & D) type. Research and development is a research type that aims to produce certain products. The produced results then tested for validity and reliability. The research and development used was Borg & Gall's design model (2003: 569-575) which consists of 10 steps. The steps that must be followed to produce the product, i.e: initial research and information collection, planning, development of initial product format, initial trial, product revision, field trial, product revision, operational field trial, final product revision, implementation. By still referring to the research and development model (R & D) by Borg and Gall (2003: 569-575), in this development process researchers will only do step one up to step seven, namely the steps of initial research and information collection up to main field trial.

17

2.2 Population and Sample

The population of this study were a fourth grade students with a total of 437 students in 8 public elementary schools in Langkapura sub-district. The sample in this study was determined by random sampling technique, with the consideration that the characteristics of the schools that were sampled were almost the same, that were using the 2013 curriculum with the achievement of different school minimum completeness criteria, the sample in this study were 2 classes in public elementary school 2 of Langkapura with a total in a fourth grade A as 28 students as an experimental class and four grade B with a total of 28 students as a control class.

Data collection instruments in this study were used to collect data from the preliminary study, product development and product trial. In the preliminary study phase, the used instruments were interview guide sheets, observation sheets, and questionnaire sheets for expert validation and teacher validation.

Data analysis used in this research activity is the analysis of qualitative descriptive and quantitative descriptive data. Analysis of qualitative descriptive data in this study was used to process data sourced from comments and suggestions which obtained from material experts and media experts which contained in the validation questionnaires, an initial trial to determine the feasibility and usefulness of student worksheets. The results of the analysis of qualitative descriptive data will be used as a condition to meet the eligibility criteria of student worksheets based on discovery learning.

Quantitative descriptive data analysis was used to analyze the data obtained in the form of validation scores of material experts and media experts to assess the feasibility of the developed student worksheets content, the results of the teacher response questionnaire is to measure the usability and feasibility of the product. As well as student test results to measure the effectiveness of student worksheets. Data on the effectiveness of using student worksheets is obtained from a written tests given to students of fourth grade in public elementary school 2

Langkapura before and after using student worksheet based on discovery learning. Written test instruments were analyzed using validity test, reliability test, difficulty level, distinguishing power test, and normalized n-gain analysis.

Validity test is done to measure the level of validity of an instrument, the formula used from the product moment correlation is as follows.

$$r_{xy} = \frac{(n - \Sigma XY) - (\Sigma X)(\Sigma Y)}{\sqrt{\{(n \cdot \Sigma X^2) - (\Sigma X)^2\}\{n \cdot \Sigma Y^2 - (\Sigma Y)^2\}}}$$

Information:

- r_{xy} = coefficient between variables X and Y
- n = Number of respondents
- X = Score variable (respondent's answer)
- Y = total score of variables (Respondent's answer)

Source: (Arikunto, 2013: 317)

The instrument is declared valid, or vice versa if $r_{count} \geq r_{table}$ with $\alpha \leq 0.05$ then the correlation coefficient is stated to be significant. In this validity test using a significance level of 0.05 with n = 26. As many as 30 questions tested were obtained 23 valid questions. The questions used to obtain research data were 20 items, so that 3 questions were not used in the study because r_{count} was smaller among the other items.

Another important requirement is reliability. The more reliable the requirements of a test, the more confident we can state that the results of a test have the same results when re-tested. Reliability test of learning outcomes instrument is done using the Spearman-Brown formula with the following formula:

$$r_{11} = \left[\frac{n}{(n-1)} \right] \left[1 - \frac{\sum \sigma_i^2}{\sigma_t^2} \right]$$

Information:

- r_{11} : Instrument reliability
 - $\sum \sigma_i^2$: Score of each item
 - N : Number of items
 - σ_t^2 : Total variance
- (Sources: Sugiyono, 2015: 90)

Table 1. List of "r" Coefficient Interpretations

Coefficient r	Reliability
0,80 – 1,00	Very High
0,60 – 0,79	High
0,40 – 0,59	Medium
0,20 – 0,39	Low
0,00 – 0,19	Very Low

(Source: Sugiyono, 2015: 257)

After calculating the reliability of the instrument student worksheet based on discovery learning, a reliability coefficient was obtained at 0.88. Based on these results it can be concluded that the tests used have very high reliability criteria.

Difficulty level analysis is intended to find out whether the questions made are relatively easy or difficult. To test the level of difficulty of the problem in this study, researchers used the Microsoft Office Excel program with the formula used to calculate the level of difficulty of each item, that is :

$$P = \frac{B}{Jx}$$

Information:

- P : level of difficulty
- B : number of students who answer true question
- Jx: the number of all test participants

(Source: Arikunto, 2013: 349)

Table 2. Interpretation of the Problem Level of Problem Level

No.	Difficulty Index	Difficulty Level
1	0,00 – 0,30	Difficult
2	0,31 – 0,70	Medium
3	0,71 – 1,00	Easy

Source: Arikunto, (2013: 349)

After calculating the level of difficulty test instruments of student worksheets based on discovery learning, as many as 30 questions were tested, the level of difficulty obtained was 15 questions with easy criteria, 13 questions with medium criteria, and 2 questions with difficult criteria.

Analyzing the distinguishing power of the questions means examining test questions in terms of the ability of the test in certain categories. The technique used to calculate the distinguishing power is to reduce the average of the upper groups who answered correctly and the average group below who answered correctly. The formula used to calculate the distinguishing power is:

$$D = \frac{B_A}{J_A} - \frac{B_B}{J_B} = P_A - P_B$$

Information: 7

B_A = The number of top group participants who answered the questions correctly.

J_A = Number of top group participants

$P_A = \frac{B_A}{J_A}$ = Proportion of group participants

7 for those who answer correctly

B_B = The number of lower group participants who answered the questions correctly.

J_B = Number of lower group participants

$P_B = \frac{B_B}{J_B}$ = Proportion of group participants

below who answered correctly.

Source: Arikunto (2013: 218)

Table 3. Differential Power Criteria Problem

No.	Classification Differentiating Power	Index
1.	0,00 – 0,19	Low/Less
2.	0,20 – 0,39	Sufficient / Moderate
3.	0,40 – 0,69	Good / High
4.	0,70 – 1,00	Very Good / High
5	Negative	Bad

(Source: Arikunto, 2013: 218)

After calculating the instrument differentiation test student worksheets based on discovery learning, as many as 30 questions were tested, the difference was obtained results were 20 questions with sufficient criteria, 6 questions with good criteria, and 4 questions with low criteria.

Furthermore, the average increase in student learning outcomes or the effectiveness of discovery-based worksheets can be tested with normalized gain. In assessing the effectiveness of measurements carried out on the cognitive aspects of students through written tests in the 8 sub-theme 2 theme learning with discovery learning-based worksheets. The formula used is as follows.

$$N - gain = \frac{skor\ akhir\ (posttest) - skor\ awal\ (pretest)}{skor\ maksimum - skor\ tes\ awal}$$

Table 4. Interpretation of normalized gain values

Index Gain	Classification	Effectiveness level.
$g < 0,30$	Low	Less Effective
$0,30 \leq (g) \leq 0,70$	Medium	Effective
$(g) > 0,70$	High	Very Effective

(Source : Hake, 1999: 21)

3. Results

3.1 Results of Development Students Worksheet Based on Discovery Learning

The results of this development study in the form of student worksheets based on discovery learning that are suitable for use in learning. The material developed was theme 8 with the title "My Living Area", the sub-theme of the uniqueness of the area where I lived in the fourth grade of elementary school.

The procedure used in this study refers to the development model of Borg & Gall which contains the following

main steps of the research:

3.1.1 Research and Initial Information Collection

This initial research and information collection was intended to collect data about the learning process at public elementary school 2 Langkapura. Empirical data results are used as reference material and consideration in developing students worksheet and how the subject be studied.

The results of preliminary research carried out by distributing questionnaires given to fourth grade teachers, principals, and students in public elementary school 2 Langkapura produced the following data: public elementary school 2 Langkapura has used the 2013 curriculum (K13) since the curriculum was first applied, teaching materials used are 2013 curriculum was purchased from the publisher, the learning was still teacher-centered, the worksheets used were not in accordance with the needs of students so that students were less active in participating when learning, there were still many students who found difficulties when asked to express opinions, and there were still many students who the learning value has not reached the minimum completeness criteria.

Based on the results obtained from the search and collection of preliminary information, the researchers concluded the need for the development of teaching materials in the form of discovery learning worksheets so that the development of this worksheet was able to improve student learning abilities which could have an impact on improving student learning outcomes.

3.1.2 Planning

The planning phase of the development student worksheets based on discovery learning is the preparation of the basic framework, the determination of the systematic presentation of material, the planning of evaluation tools, and the preparation of assessment instruments.

3.1.3 Development of the Initial Product Format

The next step of the framework that has been prepared previously is the development of student worksheets. The preparation of this student worksheets is based on aspects of presentation and content that have been planned in advance which consists of the cover page section, preface, table of contents, instructions for using student activity sheets, basic competency mapping and indicators, learning objectives, and compilation of students worksheet based on discovery learning.

3.1.4 Initial Trial

The initial trial is to find out the validity of the theoretical student worksheets product. This validity includes expert and practitioner (teacher) assessment tests. The assessment of experts was used as a basis for refining and refining the prototype. Expert judgment is carried out by submitting an assessment instrument lattice. Based on the validation carried out by material experts, the value obtained was 95.37 and the validation value obtained from media experts was 93.52. Meanwhile, the results of validation by the practitioner (teacher) get a value of 89.35. Suggestions and feedback are also given by the validator as a recommendation for improvement of product student worksheets based on discovery learning.

3.1.5 Product Revision

Next the researcher corrects the student worksheets as suggested by the validator. The researcher carried out several revisions according to those suggested by the material expert, that are adjusting the indicators with the material in each lesson, adjusting the indicators to the learning objectives, and adjusting the material that was not in accordance with the uniqueness in Lampung area. While the revisions that the researcher did based on the advice given by media experts, the images on the cover were replaced with contextual images that better reflected the contents of the student worksheets, the use of language in the student activity sheet was simplified according to the language for children of age, adjusting questions with indicators and learning objectives, and adjusting the stories contained in students worksheet with folklore from Lampung province.

3.1.6 Main Field Trial

The main field trial was conducted on April 8 2018 to April 13 2018 in class IV A of public elementary school 2 Langkapura with a total of 28 students. At the first meeting before learning activities begin, students are given a pretest first then at the sixth meeting or the last meeting after the learning ends students are given a posttest. This is intended to see the effectiveness of student worksheets based on discovery learning whether it can improve student learning outcomes before and after the implementation of learning by using student worksheets based on discovery learning.

3.1.7 Final Product Revision

This final product revision was conducted based on the results of field trials and findings when the product was tested. Based on the results of hypothesis testing that has been done, it is obtained an increase in student learning outcomes seen from the number of students who scored above the minimum completeness criteria after learning using students worksheet based on discovery learning. Furthermore, based on the results of consultations with material experts and media experts, it can be concluded that the student worksheets based on discovery learning that were developed were not revised and feasible to be implemented.

5.2 Effectiveness Test for Student Worksheets.

Test the effectiveness of the product is done to see a significant enhancement in student learning outcomes before and after using student worksheets based on discovery learning in the learning process. Enhancement of student learning outcomes after learning using student worksheets based on discovery learning theme 8 sub-theme 2 with the following results.

Table 5. Student Learning Outcomes in Field Trials

School	Average Value		Enhancement (%)
	Pretest	Posttest	
IV A (Experiment)	55,18	73,93	25,36
IV B (Control)	55,36	69,11	19,90

The table above shows the differences and enhancement of student learning outcomes in general after learning using student worksheets based on discovery learning on theme 8 My Place Of Living subtheme 2 The uniqueness of the area of my residence.

Furthermore, to test the effectiveness of learning outcomes using the N-Gain Test with the results as in table 6 below.

Table 6. N-Gain Pretest-Posttest Results after calculation

No	SD Negeri 2 Langkapura	Gain
1.	Kelas IV A (Experiment)	0,42
2.	Kelas IV B (Control)	0,31
Average		0,365

Source: N-Gain results calculated.

From the table above the average results of the pretest-posttest gain shows the results of 0.365 which means that normalized gain is in the middle classification, the level of effectiveness is effective.

4. Discussion

4.1 Development of Student Worksheets Based on Discovery Learning

The student worksheets based on discovery learning is the theme of My Places of Living the sub-theme of The uniqueness of the area of my residence, the fourth grade elementary school in the implementation of its learning using a scientific approach and an integrated thematic learning model that aims to develop the implementation of student-centered learning. Learning activities contained in students worksheet based on discovery learning uses six main steps, there are stimulation, problem identification, data collection, data processing, verification and generalization. The six steps are outlined through the development student worksheets based on discovery learning can help students become more active in the learning process so that the students abilities and student learning outcomes also become increased. Learning is a construction of meaning not just to remember and mention the facts that are factual.

This is in line with the results of research conducted by Toman (2013) which explains that worksheets developed based on constructivist approaches help students understand the subject of learning better, and increase student success, and enable students to be more active in participating in the learning process.

Student worksheets is one of the instructional learning resources that teachers can use in the learning process. Student worksheets is also a learning medium because it can be used with other learning resources simultaneously, depending on what learning activities are designed. Lee (2014) in his research shows that worksheets can be useful in many ways regarding academic achievement. Student worksheets as a supplement for books also provides additional information to assist students in constructing knowledge, while attracting students' interest when combined with certain learning media. In addition, Kyriazis et al. (2009) based on the results of his research concluded that the use of discovery learning models shows significant changes in student values.

Student worksheets as teaching material has one function as a tool that can facilitate students to understand the material presented as well as a summary of the material and many tasks to practice. Podolak and Jordyn (2013) obtained from the results of the study that students worksheet help students become more active, able to overcome their own difficulties in learning and help students improve their ability to solve problems. Student worksheets based on discovery learning theme of My Places of Living, the sub-theme of The uniqueness of the area of my residence is using as a companion book for student designed in accordance with student needs analysis, where students were previously given students worksheets from the free market or recommended publishers.

Student worksheets based on discovery learning's theme My Place of Living Area the sub-theme The uniqueness of the area of my residence is one of the innovations developed as a companion in the subject development in the 2013 curriculum student book, also because the learning step invites students to actively find solutions problems directly and get their own understanding through the steps of systematic discovery learning.

This is in accordance with Joy's (2014) opinion. Discovery is a way for those who do not know to be aware of what is done by the students themselves. then this study concludes that in discovery learning, students construct knowledge based on new information and the data collected is used by them in an explorative learning environment.

Although this student worksheet only contains one theme and one sub-theme in class IV, but it does not reduce that student worksheets based on discovery learning are one solution or alternative of good teaching materials, feasible and can be used in learning. This student worksheets development is suitable for use as a reference and companion for the development of teaching materials contained in student books and the latest 2017 edition of the 2013 curriculum book.

Effectiveness of Students Worksheet Based on Discovery Learning

The effectiveness of a teaching material can be seen from the increase or not of student learning outcomes after using the instructional materials provided. Effective or not the use of student worksheet based on discovery learning can be seen from student learning outcomes based on the high and low results obtained by students before and after using student worksheets based on discovery learning. Learning in class using student worksheets based on discovery learning is said to be effective if students' learning outcomes after using the student worksheets are higher than before using the student worksheets.

The effectiveness test is conducted to determine the effectiveness of students worksheet in the learning process that has been conducted. The effectiveness test is done to see student learning outcomes. The effectiveness of the use student worksheets teaching materials is strengthened by the opinion of Ozmen and Yildirim (2005) the results of his research showed that learning by using worksheets was more effective than the classes taught by conventional methods, this was evidenced by the significant differences in learning outcomes of the control class : experimental class.

Based on the effectiveness test using n-gain, the value of learning outcomes after using the student worksheets based on discovery learning is higher than before using the student worksheets. Based on the results of the recapitulation obtained is 0.42 in the experimental class and 0.31 in the control class, with an average value of 0.365 in the medium category. There is an increase in student learning outcomes before and after using student worksheets based on discovery learning. In addition there is also an increase in the average gain that occurs between the control class and the experimental class.

5. Conclusion

This study produces student worksheets based on discovery learning products that are designed to be used as a companion in the learning process well; student worksheets based on discovery learning products are also effective in improving student learning outcomes by significantly increasing student learning outcomes seen from differences in pretest and posttest scores, as well as significant learning outcomes between the experimental class and the control class obtained by fourth grade students in public elementary school 2 Langkapura.

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