Design of Invention-Based Student Activity Sheets Technology to Improve Learning Outcomes of Cube and Block Volume

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Abstract. This study aims to describe the characteristics of discovery learning activity sheet design for students, especially in class V SD Negeri Sukoharjo 01. The design of student activity sheets to improve student learning outcomes This study uses the Research and Development (R&D) method. describes the ten steps of conducting the research. However, in this study, due to time and cost limitations, the researcher simplified it into 7 steps, stage (1) potential and problems; (2) data collection; (3) product design; (4) design validation; (5) design revision; (6) product testing; (7) product revision. The design characteristics are based on the needs analysis of students' worksheets. The analysis of the needs of students' worksheets will be carried out on 50 students in grade 5 as the experimental class and 40 students in the control class. Collecting data using a questionnaire on student activity sheets and student learning outcomes tests. Based on the validator test, the material expert team and discovery learning activity sheet media of students were feasible to use in learning. The next stage is to determine the effectiveness of the student activity sheet by conducting a large group field test of the experimental class in class V SDN Sukoharjo 01 and SDN Sukoharjo 03.

1. Introduction
Mathematics is a major subject at various levels of education, which is able to assist mastery of other sciences, as well as in its application to aspects of everyday life. Mastery of mathematics makes a person able to compete in economics and science and technology development. However, students have not been optimal, it is proven that the ability to implant concepts for most students is still low so that learning outcomes are not satisfactory. They find math difficult and boring. Researchers assume this opinion is a result of students' unpreparedness in learning as well as heterogeneity of student abilities.

Based on the results of a survey conducted by the Program for International Student Assessment (PISA) for Indonesia in 2018 which was given by Yuri Belfal (OECD Head of Early Childhood and Scools) to the Minister of Education and Culture Nadiem Makarim, he was ranked 72 out of 78 for Mathematics with a score of 379. While the observation data for grades V and VI SDN Sukoharjo 01 Wedarijaksa Pati, it can be seen that the average value of the Final Semester Assessment results for class V Mathematics for the 2018/2019 academic year is still low and the UASBN average score for tapel mathematics 2018-2019 is much lower than the average value of the lesson content. other. Indonesian Language National Exam 77.54, Mathematics 65.65 and IPA 84.94. One of the factors is the lack of teacher creativity in using attractive learning models that are able to increase understanding of concepts and the lack of creativity of teachers in creating learning companion materials. One of
them is the Student Activity Sheet (LKPD).

To create active learning, creative in finding a new concept in mathematics learning, teachers must develop media and methods that are suitable in the current curriculum. Suitable media and methods developed in the form of student worksheets. Student worksheets (LKPD) is a collection of activities for students to carry out real activities with the objects and problems studied. As stated by Prastowo (2015: 204), student worksheets are teaching materials that have been packaged in such a way that students expected are to be able to learn the teaching material independently.

The use of LKPD will not give satisfactory results without accompanied by the use of learning models in the learning process. Learning in the 2013 curriculum prioritizes a scientific approach according to Fadlillah (2014: 175) scientific approach, namely a learning approach that is carried out through a scientific process. In 2013 curriculum learning there are several suggested learning models, including discovery learning, inquiry learning, problem-based learning, project-based learning (Annex to Permendikbud RI No. 65 of 2013). Learning with using discovery learning models provides opportunities for students to play an active role in the learning process, both learning individually and group through discovery activities. According to Abdullah Sani (2014: 98) states that discovery learning is a learning method which requires teachers to be more creative in making students learn to actively discover own knowledge.

So far, the student activity sheets used are products from publisher prints that are not in accordance with the characteristics of students, only demanding to solve existing problems without stimulating the planting of concepts so that researchers are interested in taking this development research which aims to improve student learning outcomes in cube volume material and beam.

a. Student Activity Sheet (LKPD)

According to the Ministry of National Education (in Prastowo, 2012: 207) states that student worksheets serve as learning guides for students and also make it easier for students and teachers to carry out teaching and learning activities. Student worksheets are usually in the form of instructions, steps to complete a task, a task that is ordered in the activity sheet must be clear about the basic competencies to be achieved. Meanwhile, according to the National Education Ministry (in Prastowo, 2012: 211-215) the stages are: 1) Curriculum analysis is determining material by considering the main material to be taught, learning experiences, and the competencies of students. 2) Prepare a map of the number of LKPDs needed. 3) Determine the title of the LKPD (basic competencies can be used as titles). 4) formulate basic competencies, 5) compile materials and 6) pay attention to the structure of teaching materials. 7) determine the assessment tool.

According to the Ministry of Education and Culture's Syah (2013: 5), the procedure for the learning discovery learning process is as follows:

1. Stimulation, at this stage students are faced with something that causes them confusion,
2. Problem Statement, at this stage the teacher gives students the opportunity to identify as many problem agendas as possible that are relevant to lesson materials, then one of them is selected and formulated in the form hypothesis
3. Data Collection, at this stage students are given the opportunity to explore. When the teacher's ongoing exploration also gives students the opportunity together as much relevant information as possible to prove whether the hypothesis is true or not.
4. Data Processing, at this stage students process data and information have been good through interviews, observations, and so on, then interpreted.
5. Verification, at this stage students carry out careful checks for prove whether or not the predetermined hypothesis is true with findings alternatively, linked to the results of data processing.
6. Generalization, at this stage students draw conclusions that can be made a general principle and applies to all the same events or problems with due observance of the verification results.

b. Learning outcomes

Learning outcomes are assessments of learning outcomes expressed in numbers, letters or sentences that reflect the results that students have achieved in one period. Learning is always a change in
behavior or appearance, with a series of activities such as reading, observing, listening, imitating and so on. "(Sardiman, 2005: 20).

c. Mathematics
In the Ministry of National Education in 2006, mathematics subjects at the SD education unit level include the following aspects: a) Numbers; b) Geometry; c) Measurement; d) Data Processing. According to Heruman (2008: 3) suggests that the steps that teachers must take in learning Mathematics in elementary schools include: Finding basic concepts (planting concepts), namely learning a new concept of mathematics, when students have never studied the concept. Based on the background and problems above, the purpose of this study is to describe the design of the characteristics of discovery learning-based student activity sheets based on the analysis of the needs of student activity sheets according to the perceptions of students and teachers and to determine the increase in student learning outcomes.

2 Research Methods
This study uses a research and development design with implementation that refers to the theory of Borg and Gall.

2.1 Data Source
Sources of data used in the research on the development of discovery learning for grade V elementary school students include the data subjects in this development research are class V SDN Sukoharjo 01 and 03 with a total number of students of 50 students, namely as the experimental class and class V SDN Margorejo and SDN TAwangharjo with a total of 40 students as the control class. The type of data collected from this study comes from needs analysis data and student learning outcomes data.

2.2 Data collection technique
Data collection techniques in this development research are in the form of a questionnaire sheet for the needs of teachers and students, instruments of attitudes, understanding, and skills. Testing of learning outcomes is carried out using the N-gain test. The results of the N-gain test are interpreted by the gain (g) classification interpretation table. Hypothesis testing involves two population groups, then hypothesis testing uses the t-test (t-test).

2.3 Test Analysis Technique
The test analysis technique used in this development research includes testing the validity of the questions, the reliability of the questions, the difficulty level of the questions, and the distinguishing power of the questions. Arikunto (2013: 85) explains that a test is said to have validity if the results are in accordance with the criteria, in the sense that it has parallels.

3 Results and Discussion

3.1 Needs Analysis
Based on the results of the needs analysis, student worksheets will be designed which have characteristics according to the needs of teachers and students.

a. Aspects of the content of the material were produced. The results of the needs analysis on the development of discovery learning-based student activity sheets for the volume of cubes and blocks for fifth grade elementary school students on the feasibility aspect of the content included six things, namely, types of teaching materials, themes, types of stories, materials, material presentation, the content of the material, and the insertion of the character, attitude, knowledge and skills.

b. Language, is a means of delivering and presenting teaching materials, such as vocabulary, sentence structure, paragraphs, and level of interest according to students' interests and levels of knowledge. Linguistic feasibility is related to the legibility aspect related to the level of language ease which includes vocabulary, sentences, paragraphs and discourse. There are four principles related to readability, namely the principle of convenience, the principle of attractiveness, the principle of communication, the principle of conformity.
c. Presentation, the principles used in discovery learning-based student activity sheets. The volume of cubes and blocks from the feasibility aspect includes the principles of being active, interesting, creative, and innovative, and systematic.

d. Graphs in terms of physical design and graphics on student activity sheets are an attraction that affects student motivation when learning the volume of cubes and blocks which include book design, paper and book sizes, typography, and layout of book covers and contents by paying attention to interesting, creative principles, and innovative, the principle of practicality.

3.2 Product Development of Student Activity Sheets

Product development student activity sheets discovery Learning material volume cubes and blocks for fifth grade elementary school students in the form of a learning companion book consisting of three student activity sheets. Namely student activity sheets one learns the properties of cubes and blocks, student activity sheets two learned about calculating the volume of cubes and blocks through the unit cubes of the rainbow and the third learned about calculating the volume of cubes and blocks in everyday life. Each student activity sheet includes stimulus, problem identification, data collection, data processing, verification, conclusions in the form of assignments for students (Figure 1, Figure 2, Figure 3, Figure 4, and Figure 5).

Figure 1. The introduction to the companion book

Figure 2. Companion Worksheet Activity
Figure 3. The part of the stage of stimulation and indentification problem student activities

Figure 4. The stage section data processing
3.3 Validation from material and media experts

The results of the media expert's assessment based on a questionnaire showed that the student activity sheets were feasible to continue. This indicates that the student activity sheets can be used in material volume cubes and blocks. Revisions made to the choice of color in the material properties of cubes and blocks have been adjusted to the demands of media experts. As for the input and suggestions from media experts, what is given is such as: The use of sentences should be clearer, colors are in line with the writing. Both suggestions or input from these experts have been revised by the author in order to improve the quality of the student activity sheets that will be produced.

In the material expert test stated that the student activity sheet was declared valid and in accordance with the basic competencies and learning objectives contained in the mathematics syllabus. Material experts provide constructive comments and input, namely revising math sentences to make them more effective. Broadly speaking, it states that LKPD is feasible to use. Based on the two material and media experts, it indicates that the application of the discovery learning model in the student activity sheet is appropriate for use in learning volume cubes and blocks. By applying the steps of the discovery learning model in LKPD, students become more active in exploring their knowledge and making them more independent in the teaching and learning process. The Validator Team are Mr. Dr. Sumaji, M.Pd and Mr. Dr. Gunawan Setiadi. S.IP. M.Pd, from the UMK teacher training faculty lecturer. Based on the results of the assessment of material experts and experts, it indicates that the student activity sheet products that have been developed are suitable for use in learning volume cubes and blocks to be tested in improving the quality of student learning outcomes.

3.4 The Effectiveness of Student Activity Sheets

The effectiveness of discovery learning-based student activity sheets to improve learning outcomes of the volume of cubes and blocks for fifth grade elementary school students began with a limited trial of 31 students of SDN Sukoharjo 01, namely by starting with the perception of conveying greetings, motivation and delivery of learning objectives. In the core activity, students are formed in groups and then guided to read the material in student books and work on various activities in discovery learning-based student activity sheets in groups or independently. Various kinds of activities carried out by students include reading, making observations and practicing presenting the results of activities, proving then drawing conclusions.

The next stage is to see the effectiveness of learning tools by conducting large group field tests in class V SDN Sukoharjo 01 and SDN Sukoharjo 03. In order to produce valid and effective discovery learning-based student activity sheets that will be compared with the control class SDN Tawang Harjo and SDN Margorejo. Discovery Learning-based student activity sheets serve as a medium for delivering material and as an alternative to improve learning outcomes in the affective, cognitive and psychomotor domains.
In discovery learning, starting from the strategy to the path and the findings are determined by the students themselves. This is in line with Maier's opinion (Winddiharto: 2006) which states that what is found, the path, or process is solely discovered by the students themselves. The involvement of students in finding concepts in giving a deeper impression to students so that information is stored longer in students' memory.

With the help of discovery learning-based student activity sheets, the material presented to students becomes meaningful. Learning by using discovery learning-based student activity sheets is expected to improve student learning outcomes, because the increase in students in finding the concept of knowledge becomes more meaningful in their memory. With the development of discover learning-based student activity sheets, it is hoped that it can help teachers during the learning process and be able to make students active, and independent in the learning process, responsible and take the initiative to recognize their learning needs, find sources of information to be able to answer their needs, and build and presenting their knowledge based on the needs and sources found.

4. Conclusion

This development research can be concluded that the results of the needs analysis are then formulated in the design of the characteristics of student activity sheets in the form of developing principles and using student activity sheets. The principle of developing student activity sheets includes four aspects. The content / material aspect consists of the principle of completeness, the principle of suitability, contains character education, the principle of convenience, the principle of relevance, and the principle of benefit. The linguistic aspect consists of the principle of convenience, the principle of attraction, the principle of communicability, and the principle of conformity. The presentation aspect consists of interesting, creative, and innovative principles; systematic principle; and the principle of activity. The graphic aspect consists of interesting, creative, and innovative principles and principles. The principle of using teaching materials consists of the principle of convenience and the principle of practicality.

Discovery learning-based student activity sheets technology were developed based on KI and KD which became the reference for the 2013 curriculum for grade V SD and presents clear illustrations, contrast images and very clear material descriptions and is equipped with activity sheets for each LKPD and produces products that can hone creativity students. Based on the results of the data analysis that has been done, it can be concluded that the LKPD based on Discovery Learning on the volume of cubes and blocks is designed to be valid and ready to be tested for its effectiveness to improve learning outcomes of fifth grade elementary school students.

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