**The Effect of Using Simple Aircraft Concrete Media on the Mastery of Concepts in Inquiry Science Learning in Elementary School Students**

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**Abstract**

This study aims to determine the increase in mastery of concepts in inquiry learning science through the use of simple concrete media. The research approach used quantitative research with a quasi-experimental method and a nonequivalent control group design.PThe study involved 60 fifth grade students of SDN 1 Nagrikidul, Purwakarta district. In the control class, conventional learning assisted by audio-visual media is applied. And the experimental class applied science learning by inquiryunite concrete media. The results showed that the gain normalization test for increasing the mastery of science concepts in the experimental class (N-gain 0.44) was greater than the gain value for the control class (N-gain 0.23). Based on the test results the difference between the two means is obtainedtcount = 3.368> ttable = 2.045, with a sig. 0.002 <αamounting to 0.05 then H0 is rejected and Ha is accepted. ThereforeInquiry science learning by utilizing concrete media can significantly improve the mastery of science concepts in elementary school students.

Keywords: Concrete Media, Inquiry, and Mastery of Science concepts.

**INTRODUCTION**

Natural science is learning for elementary school students who play an important role in training critical power, analysis and higher-order thinking about natural phenomena or events. In addition, science plays an important role in the development of science and technology through experiments and discoveries (Kejora, 2020: 1).

In essence, science can be viewed in terms of products, processes and the development of a scientific attitude (Sulistyorini, 2007: 7). In both conceptual and practical settings, science studies nature and everything in it, both living and non-living. Science learning broadly includes natural phenomena arranged systematically through various experiments and observations by Samatowa (2010: 3), meaning that science has interrelated dimensions of products, processes, and attitudes.

Product dimensions in science are facts, concepts, principles, laws, and theory. Science as a product can be interpreted as the result of a process, in the form of knowledge taught both inside and outside of school (system of ideas). Scientific process activities that produce products in the form of knowledge will not be successful without the scientific attitudes of the actors (researchers).

Science as a process can be defined as a scientific activity that discusses natural phenomena and for finding new knowledge (ways of finding out). Thus the process dimension is the process of obtaining natural science compiled and obtained through scientific methods. Furthermore, it is said that science is not only a collection of knowledge about objects or living things but is a way of working, a way of thinking and a way of solving problems (Asmawati, 2016: 1).

In the implementation of science learning, both the process and the findings are interconnected. The discovery process is needed to gain mastery of concepts, while the findings are in the form of an understanding of science which emphasizes direct giving to develop student competencies in gaining an understanding of science (Yusuf, 2016: 1). In understanding science, a learning process is needed that trains students to know how a phenomenon can occur, and not only knowing but also having to be able to explain why this phenomenon can occur.

Mastery of concepts in science learning needs to be developed so that students can find their own concepts to understand the material and improve their learning outcomes. This becomes very important for students as a provision in studying phenomena that exist in nature in certain ways to obtain this knowledge and be useful in the development of that knowledge in the future (Bundu, 2006: 12).

Mastery of concepts is closely related to the cognitive realm. This cognitive domain includes the ability to restate the concepts or principles that have been learned, with regard to thinking skills, competence in gaining knowledge, recognition, understanding, conceptualization, determination and reasoning. Learning objectives in the cognitive realm (intellectual) or what according to Bloom (1959) are all activities involving the brain divided into 6 levels according to the lowest to the highest level which is denoted by C (Cognitive) including C1 (Knowledge), C2 (Understanding / Comprehension), C3 (Application / Application), C4 (Analysis / Analysis), C5 (Synthesis / Synthesis), and C6 (Evaluation / Evaluation).

Furthermore, Asmawati (2016: 14) emphasizes that to solve problems, a student must know the relevant rules and these rules are based on the concepts they get. So that the aspects of mastery of the science concept can be achieved optimally by students, of course the right media, models, strategies, methods and approaches are needed, so that in the process cognitive abilities are provided.

So far, in general science learning in elementary schools has not led to efforts to direct students in mastering the concept of science through scientific and practical activities. Yusuf (2016) in his research revealed: (1) 80.7% of science learning emphasizes macroscopic and symbolic aspects carried out through lectures and exercises assisted by LKS; (2) 59.2% management of learning and delivery of science material by teachers is delivered verbally (3) 85.2% of science teachers show a monotonous and conservative teaching pattern, namely by directly adopting the order of the subject matter in the book used and (4) 23.1% of practicum implementation by science teachers focuses more on activities that are verification, not investigation. In other words, students are crammed with various theories and memorization of science concepts but have poor learning experiences. This makes children memorize various theories but they do not master the concept of science, especially in the axiological aspect of solving problems.

Students experience weak mastery of science concepts, especially in simple aircraft material. Show do we know that uTo facilitate our daily work, we need a tool called a simple airplane. There are 4 types of simple aircraft, namely levers (levers), inclined planes, wheels, and pulleys. The purpose of using a simple airplane is to 1) multiply our force or ability, 2) change the direction of the force we are acting on, and 3) travel a greater distance or increase our speed.

Based on preliminary studies, it was found that the phenomenon of children understanding simple planes as objects that can fly with a simpler shape (not like an airplane). For this reason, teaching media are needed that can help provide real experiences to students through seeing, feeling and feeling the teaching aids used. For this reason, the use of concrete media in the form of simple aircraft is expected to be able to present a more concrete learning experience that will be more appropriate for elementary school age children. This can help the child get the correct concept of what he is learning.

Concrete objects or better known as real objects or real objects are objects that are used to realize what is in the mind with the real object (Hosnan, 2014: 115). Real objects are used to explain abstract words or give real life meaning because students gain direct experience. With concrete media, it allows teachers to be able to provide real illustrations to students. This illustration is illustrated through examples that can be obtained everyday. With these examples, students are expected to play an active role in learning and be able to discover the role of science and technology in people's lives. Even by starting learning with issues (themes) that are common around students, it is hoped that students can continue to develop the mastery of the concepts they have acquired.

The existence of concrete media in the form of simple planes needs to be applied through the right strategy or learning approach. Science learning that encourages to emphasize providing direct learning experiences through the use and development of mastery of scientific concepts and attitudes when they are facilitated to construct their own knowledge, is known as science learning which uses a scientific inquiry approach (scientific inquiry).

Inquiry is learning that focuses on activities and providing direct learning experiences for students. That way, students can increase student understanding and students have the opportunity to apply knowledge so as to increase their mastery of concepts. Inquiry learning will have a learning impact on students' positive mental development because through this learning, students have ample opportunity to find and find for themselves what they need, especially in abstract learning (Asmawati, 2016: 3).

Problems in learning science in elementary schools are of course important to find solutions. For this reason, it is also important to carry out an objective researchtoknow the increase in concept mastery in science learning in inquiry assisted by concrete media, especially in the concept of simple aircraft that includes lever material, inclined plane, pulley and axle wheel. Mastery of the concepts studied in this study is limited to 4 aspects, namely the domain of concept mastery used in this study is only four categories of concept mastery, namely C1 (Knowledge / Knowledge), C2 (Comprehension), C3 (Application), and C4. (Analysis / Analysis).

**RESEARCH METHODOLOGY**

This research is a quantitative study with a quasi-experimental method. The design used is the Non equivalent Control Group Design (Sugiyono, 2016: 118) which is described as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Experiment | O1 | X1 | O2 |
| Control | P1 | X2 | P2 |

Information:

O1 = Pretest of mastery of concepts (experimental class)

O2 = Posttest mastery of concepts (experimental class)

X1 = Treatment in the experimental class (Science learning by inquiry assisted by concrete media)

X2 = Treatments in dick class (Science learning assisted by audio-visual media)

P1 = Pretest of mastery of concepts (Control class)

P2 = Posttest mastery of concepts (Control class)

This design compares the pretest-posttest value of the experimental class that is given treatment using concrete media in science learning by inquiry and the pretest-posttest control class that is given treatment using audio-visual media in conventional science learning.

The population chosen was all students in class V-A and class V-B SDN 1 Nagrikidul Purwakarta as many as 60 students. The sample selection was selected by a population sample, namely by selecting 30 class A students as the experimental class and 30 class B students as the control class.

The research was carried out in three stages, namely: (1) the preparation stage, (2) the implementation stage, and (3) the final stage. At the preparation stage, iproblem identification, literature study, curriculum review, pDetermination of research subjects, preparation of instruments and testing of research instruments. At the implementation stage, it was carried out giving a pretest, implementing learning, giving posttest, processing the pretest and posttest data and analyzing the results of the achievement of mastery of the science concept. The final stage is the stage of giving input in the form of conclusions and suggestions.

The learning tools used were in the form of lesson plans, worksheets, and simple plane concrete media. The instruments or data collection tools in this study were in the form of learning observation sheets and tests. The observation sheet is used to measure the feasibility of the science learning stages by means of assisted inquiryconcrete media. The test used is in the form of multiple choice (objective tests) a number of 34 questions including levers, inclined planes, pulleys and axle wheels with mastery of concepts covering 4 indicators, namely C1 (Knowledge), C2 (Comprehension), C3 (Application / Application), and C4 (Analysis).

The results of the concept mastery test were then analyzed using a software application *Statistical Product and Service Solution (SPSS) 25.0 for Windows*. Data analysis was carried out in the form of descriptive analysis, assumption test (normality test and homogeneity test), paired sample test and performing gain normalization test (N-gain). As for pcalculate the average N-gain using the following gain formula:

<g> = $\frac{(S post-S Pre)}{(S mid-S Pre)}$

information :

g = average normalized gain score

Spost = posttest score

Spre = pretest score

Smid = maximum ideal score

The results of the gain value are then consulted in the table for interpretation.

**Table 1. N-gain criteria**

|  |  |
| --- | --- |
| N-gain interval | Category |
| g <0.3 | Low  |
| 0.3 ≤ g ≤ 0.7 | Moderate  |
| g> 0.7 | High |

Furthermore, in order to make it easier to interpret learning outcomes in the form of mastery of the science concept, the norm of categorization of the value of mastery of the science concept is applied which refers to the categorization of learning outcomes according to Muhibbin Syah (2015) as follows:

**Table 2. Criteria for Assessment of Mastery of Science Concepts**

|  |  |  |
| --- | --- | --- |
| No. | Score | Criteria |
| 1. | 0 - 49.99 | Very less |
| 2. | 50 - 59.99 | Not good |
| 3. | 60 - 69.00 | Pretty good |
| 4. | 70 - 79.99 | Well |
| 5. | 80 - 100 | Very good |

**DISCUSSION**

**Implementation of Inquiry Science Learning**

The teacher's activity in inquiry learning science consists of seven stages of learning, namely: (1) orientation, (2) formulating problems, (3) formulating hypotheses, (4) collecting data, (5) testing hypotheses, (6) formulating conclusions, and (7) final activities. Based on the results of observations during the learning process, the teacher has 100% (optimally) carried out the science learning in inquiry assisted by concrete media in accordance with the steps that have been determined.

***Student activities***

At the beginning of learning, students are guided to sit in groups and are prepared to be able to carry out learning activities properly. Learning takes place in four learning activities. And based on the results of observations with the observer, during the four learning activities, not all students were 100% actively involved in research activities. Although in general most students can be actively involved in research activities according to the LKS that have been provided, students are still found not focused and busy playing with other fellow students. This may be because not all students can be involved in conducting research in their groups. Students who do not get a role, either holding tools or holding worksheets and writing become unfocused,

Another obstacle that appears is that the teacher sometimes takes too long to handle problems in a group that is experiencing difficulties. As a result, other groups who also need guidance feel neglected and bored of waiting. This also causes more and more students to do other activities. The next obstacle is the limited time for teachers and students to do science learning by inquiry.

This incident resulted in a lack of mastery of the material by students who were not actively involved in research activities so that the scores of some of these students were not satisfactory and the increase in concept mastery was less than optimal. This needs to be a separate note and must be considered by teachers who will carry out learning activities through research.

**Concept Mastery**

A total of 34 questions for mastery of science concepts were given to students in the experimental class and control class, in the form of pre-test and post-test questions. The material being tested on simple planes includes levers, inclined planes, pulleys, and axle wheels. The aspects of concept mastery measured include 4 (four) cognitive levels (C1, C2, C3, and C4).

To determine the increase in the mastery of concepts that have been achieved by students and their qualifications, a normalized gain score (N-gain) is used. Improved conceptualization described in this section consists of general improvements and improvements for every aspect of concept mastery. The increase in concept mastery was determined through processing data on the initial test mean, final test and N-gain in both samples.The following are the results of concept mastery in the experimental class and control class.

**Table 3. Achievements of Science Concept Mastery**

| No. | MASTER OF CONCEPT | Experiment | Control |
| --- | --- | --- | --- |
| Pre | post | Gain | Category | pre | post | Gain | Category |
| 1 | C1 (Knowledge) | 50.00 | 65.03 | 0.28 | Low | 45.42 | 61.76 | 0.30 | Moderate |
| 2 | C2 (Comprehension) | 54.41 | 70.88 | 0.31 | Moderate | 50.88 | 57.06 | 0.12 | Moderate |
| 3 | C3 (Application) | 52.94 | 70.92 | 0.35 | moderate | 54.90 | 55.56 | -0.01 | Low |
| 4 | C4 (Analysis) | 55.39 | 67.16 | 0.24 | Low | 55.88 | 67.65 | 0.23 | Low |
| GAIN | 0.44 | Moderate | 0.23 | Low |

|  |  |
| --- | --- |
|  |  |

The results of the students' final test average in the experimental class showed a higher increase than the control class. The N-Gain index of concept mastery in the experimental class (0.44) was included in the medium category and the N-Gain index for the control class (0.23) was in the low category.

The science mastery data in two classes and the N-gain data were then carried out by the analysis requirements test in the form of a normality test and a homogeneity test. The results are shown as follows:

**Table 4. Normality Test & Homogeneity Test**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Class | Score | Average | Normality test | Homogeneity Test |
| **Sig** | **Result** | **Sig** | **Result** |
| Experiment | Pre  | 62.16 | 0.69 | Normal | 0.136 | Homogeneous |
| Post  | 79.61 | 0.48 | Normal |
| Control | Pre  | 60.39 | 0.62 | Normal | 0.365 | Homogeneous |
| Post  | 67.06 | 0.66 | Normal |
| Experimental Gain | 0.44 | 0.81 | Normal | 0.726 | Homogeneous |
| Gain Control | 0.23 | 0.64 | Normal |

Based on the data, it can be seen clearly that the data of the two classes and the gain data for the aspect of normalized concept mastery are homogeneous, this can be seen from the significance ≥ 0.05. The data analysis was continued to test the hypothesis regarding the difference in the improvement of concept mastery in the experimental class and the control class.The hypothesis was formulated in the form of a statistical hypothesis of the average difference test as follows:

H0: µ1 = µ2

Ha: µ1 ≠ µ2

with

H02: There is no significant difference between the increase in concept mastery of students who receive inquiry learning by utilizing concrete media and the conceptual mastery of students who receive conventional learning assisted by audio-visual media.

Ha2: There is a significant difference between the increase in conceptual mastery of students who receive inquiry learning by utilizing concrete media and the conceptual mastery of students who receive conventional learning assisted by audio-visual media.

**Table 5. Hypothesis Test Results of Concept Mastery**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Class | Score | Average | t-Count | Table | Sig |
| Experiment | N-gain | 0.46 | 2,688 | 2,045 | 0.012 |
| Control | 0.17 |

Based on the calculation, the tcount is 3.368 at the significance level orαof 0.05, the degrees of freedom df (29) so that t table (29) = 2.045. By looking at the results of tcount and ttable, it can be seen that tcount = 3.368> t table = 2.045, with a sig. 0.002 <αamounting to 0.05 then H0 is rejected and Ha is accepted. This shows that there is a difference in the average increase in concept mastery of students who receive inquiry learning by utilizing concrete media with the mastery of concepts from students who receive conventional learning assisted by audio-visual media.

The results of data analysis showed that the experimental class N-Gain (0.44) was greater than the control class N-Gain (0.23). Thus, it can be concluded that learning using concrete media in inquiry learning science improves concept mastery more than conventional learning assisted by audio-visual media.

The difference in student final test results is of course influenced because in inquiry learning science by utilizing concrete media, students are motivated to seek their own knowledge through the experiences presented in learning. This is in line with what was expressed by Hosnan (2014) that real objects are used to explain abstract words or give real life meaning because students experience direct experience. The presence of concrete media in stimulating student questions on strengthening activities in learning has quite a lot to do with learning outcomes, because by bringing up concrete media that is in accordance with the concept of the material so that the material to be studied becomes concrete for students because it can be encountered by students in their daily lives.

Hosnan (2014) states that inquiry learning brings students to a problem that contains a puzzle. The problem presented is a problem that challenges students to think about solving the puzzle. It is said to be a riddle because there is certainly an answer in the problem or puzzle, and students are encouraged to find the right answer. The process of seeking answers is very important in inquiry activities. Therefore, through this process, students will gain valuable experience as an effort to develop mentally through the thought process.

Inquiry activity begins by presenting students with an enigmatic event. These events are of course natural events that students can experience everyday. The presence of this concrete media will generate curiosity in students to then seek their own knowledge through experimental activities. The learning process will run well and creatively if the teacher provides opportunities for students to find a concept, theory, rule, or understanding through examples that they encounter in their life.

Hidayat (2008) in his research states that the inquiry training learning model can create conditions so that students ask why an event occurs, carry out activities, seek answers, process data logically so that students carry out intellectual development strategies that can be used to find why a phenomenon can occur. Active student involvement in learning is very important in cognitive learning theory because only by activating students will the process of assimilation and accommodation of knowledge and experience occur well. The increase in students' abilities after inquiry learning is because in the presentation of each material during the learning process, it focuses more on student activity in learning so that it is faster to assimilate science concepts and principles.

Learning to understand will be more meaningful than learning to memorize. To be meaningful, new information must be adapted and linked to the knowledge students already have. By being actively involved in learning activities, it is clear that students' understanding and mastery of science concepts is better when compared to classes that only do conventional science learning assisted by audio-visual media.

Increased mastery of science concepts in classes that carry out inquiry learning science by utilizing concrete media is in line with the results of research conducted by Yusran (Tarmidzi: 2011) which states that inquiry learning can increase students' intellectual potential because they are given the opportunity to look for and find regularities. things that are interconnected through the framework of their own observations and experiences so as to prolong the student's memory process for a long time. The process that students experience makes the information that enters the student's memory bank more durable and easier to recall when needed.

In the experimental class that carries out inquiry learning science by utilizing concrete media, learning activities focus more on student activeness so that students are faced directly with investigative situations that make it easier for students to relate the newly acquired knowledge to the knowledge that is already in their minds.

The increase in student ability is caused through inquiry learning, students carry out separate experiments so that students are directly exposed to an atmosphere of investigation which in turn can help them identify a problem conceptually so that students more quickly assimilate the concepts and principles in science lessons. Whereas in a class that implements science learning conventionally, the teacher considers that teaching is only limited to delivering subject matter, so the results will of course be different from classes that involve active students in learning activities because the teacher in this class thinks that teaching is a process of providing assistance to students (Sanjaya, 2008).

**CONCLUSION**

Inquiry-based science learning using simple plane concrete media can improve conceptual mastery of elementary school students. However, it is necessary to make various improvements and further improvements. So that learning can achieve the goal of optimal improvement, pThere needs to be a directed and systematic learning plan. The inquiry learning stage should be integrated with concrete media and the conceptual mastery stage. In the implementation of learning, conditioning needs to be done effectively and efficiently considering the limited learning time, for that it needs to be supported by worksheets and clear practicum procedures in guiding students. Also needed is a question instrument that is relevant to the aspects of conceptual mastery that will be strengthened. In addition, it is also important to design learning media that can be used in conventional learning to improve concept mastery.

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