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Development of Physics Learning Devices with Group Investigation Type Cooperative Model to Improve Students Logistics Thinking Ability in Senior High School

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Abstract
This research is a development research that aims to develop Physics Learning Tool with Cooperative Model of Group Investigation Type to Improve Logical Thinking Ability of High School Students. This research uses the ADDIE development model which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. Validation of Learning Devices was carried out by involving three validators who assessed the feasibility of media, material, and educator responses. The sample in this study was class XI consisting of 25 students who were given a pretest and post test. Data analysis techniques were carried out based on the stages of the ADDIE development model. The results showed that the learning tools developed had a high level of validity, were practical, and effective in improving students' logical thinking skills. The use of this learning tool has a positive impact in improving students' understanding of physics learning on temperature and heat material as well as improving students' logical thinking skills in physics learning.

Keywords
Cooperative Group Investigation Type, Logical Thinking, Learning Device Development, SMA YP. PGRI 3 Makassar, ADDIE

INTRODUCTION

Physics is one of the branches of science that has a significant role in life, especially in the field of science and technology that has developed rapidly at this time. The concepts in physics itself are the result of observations and research on various phenomena of the universe studied through experiments in the laboratory. Because in essence physics is a collection of knowledge, ways of thinking, and investigation (experimentation), its application in effective and efficient learning and able to make students interested and motivated to study physics. One of the supporting facilities for learning physics is the laboratory. In the laboratory can be carried out activities to research and seek answers from the science studied including physics. Physics is built from careful observation, and the results of observations must be associated with a rational explanation of the theory. Conversely, a theory must be able to predict what will be observed due to the theory (Ariesta & Supartono, 2011).

The role of the teacher in learning, especially in the cooperative model of group investigation type, is as a counselor, consultant, and friendly critic (Joyce, et al 2009: 318). Group Investigation (GI) is one of the most complex types of cooperative learning. Learners are involved in planning both the topics studied and the course of their investigation. This model teaches students good group communication and group process (Wiratana, et al 2013).

In essence, physics is a collection of knowledge, ways of investigation, and ways of thinking seen as a product, process, and attitude. Physics learning should involve students in learning activities both physically and mentally on the problems of quantification, observation, and experimentation to the conclusion. Interaction in good learning between teachers and students will be able to encourage cognitive development and logical thinking skills of students in a better direction which in turn can display optimal cognitive learning outcomes (Rafafy, 2016). In order to form good interactions in a learning process, a model and learning tools are needed as a means of support so that they can improve the logical thinking skills of students.

Based on this statement, we can realize that currently education must be well directed and must be pursued by every learner with full responsibility and faced with enthusiasm. Currently, education in Indonesia is directed to improve the nation's competitiveness so that it can compete in the global market. The nation's goals can be achieved if education in Indonesia can run well. In addition, education in Indonesia also aims to be able to improve the ability and thinking skills of students, especially in improving logical thinking skills.

From the explanation above and the findings in the field, the researcher tries to provide alternative solutions and is interested in developing learning tools by applying a cooperative learning model of group investigation type to improve logical thinking skills that have never been done at the school. The learning tools referred to in this study are part of the infrastructure. The appropriate physics learning tools are very important in an effort to achieve physics learning objectives. In addition, learning tools can make it easier for students to learn. Learning tools are a prerequisite for optimal teaching and learning interactions. So, the existence of learning tools will affect the success of the learning process in the classroom. Teachers will be easier to teach a material, while students will be easier to understand the material taught by the teacher. Therefore, learning tools are absolutely necessary for a teacher in managing learning.

In the cooperative learning model of group investigation type, the learning tools to be developed are Learning Implementation Plan (RPP), Learner Worksheet (LKPD), and Logical Thinking Ability Test (TKBL) The learning tools that were successfully developed were then tested on Class XI students of SMA YP. PGRI 3 Makassar. The trial is intended to determine whether the learning tools developed are effective in improving the logical thinking skills of students. Starting from the description above, the researcher will conduct research on the development of learning tools with the title “Development of Physics Learning Tools with Cooperative Group Investigation Type Models to Improve Students' Logical Thinking Skills in High School”.

Problem Formulation

Based on the background stated above, the problem formulations in this study are as follows. How is the needs analysis of physics learning tools with the Cooperative Group Investigation Type model to improve the logical thinking skills of high school students?

MATERIALS AND METHODS

Definition of Learning Model

The learning model is a conceptual framework that describes and illustrates systematic procedures in organizing learning and learning experiences to achieve certain goals, and serves as a guide for teaching planning for teachers in carrying out learning activities, Sagala (2009: 175). While the function of the learning model is as a guide for learning designers and teachers in planning teaching and learning activities The characteristics of the learning model are: (1) based on educational theory and learning theory from certain experts, (2) has a specific educational mission or purpose, (3) can be used as a guide for improving teaching and learning activities in the classroom, (4) has parts of the model, namely the sequence of learning steps (syntax), reaction principles, social systems, and support systems. (5) has an impact as a result of the application of the learning model, (6) make teaching preparations with the guidelines of the learning model he chose (Rusman, 011: 135).

Group Investigation Type Cooperative Learning Model

The Group Investigation (GI) model is one type of cooperative learning. The most extensive and successful research in cooperative learning with task specialization is the Group Investigation (GI) model. The basics of the GI model were designed by Herbert Thelen, further expanded and improved by Sharan and his colleagues from Tel Aviv University. The GI model involves learners since planning, both in the selection of topics and the way to learn them through investigation. The GI model requires learners to have good communication skills and group process skills. In using the GI model, learners are generally divided into groups of 5 to 6 learners with heterogeneous characteristics.

Learning Theory of Constructivism

Group investigation learning model is a cooperative learning model that involves students maximally in learning activities starting from planning the topics to be studied, how to carry out the investigation, to conducting group presentations and evaluations. The underlying theory of cooperative learning is constructivism theory. Constructivism theory prioritizes the learning of learners who are faced with complex problems to find solutions, then find simpler parts or expected skills.

The definition of constructivism theory when viewed in general views science as not only limited to revealing facts, rules, and concepts that must be remembered by default. Where this constructivism emphasizes that it is humans who must construct knowledge themselves. Thus, it is humans who will later provide sentimental value and also explore knowledge, be it through study, research, or through experience. There are many ways that can be done to construct and

develop knowledge. Constructivism is a learning theory that promotes the independent development of competencies, skills or knowledge by learners facilitated by educators through various kinds of learning designs and actions needed to produce the changes needed by learners.

Logical Thinking

According to Albrecht (in Saragih, 2017), in order for someone to arrive at logical thinking, he must understand logical postulates which are verbal maps consisting of three parts and showing progressive ideas, namely: (1) the premise or the reality on which it rests; (2) the argumentation or the way of putting the premise together, and; (3) the conclusion or the result reached by applying the argumentation to the premise. This means that logical thinking needs a progressive idea or needs an indicator of achievement in order to understand the logic of students. According to Fitriana (2015: 89) Logical thinking can be interpreted as a thinking activity to obtain knowledge according to a certain pattern or certain logic. So thinking is a general process for determining an issue in the mind, while logic is the science of thinking, although two people can think about the same thing, their conclusions both reached through thinking may be different.

Based on the background and formulation of research problems that have been stated, this type of research is a development research (research and development). Development Research in question is research conducted to develop learning tools which include Learning Implementation Plans (RPP), Learner Activity Sheets (LKPD) and Logical Thinking Ability Tests (TKBL) which are implemented through a cooperative learning model of group investigation type. To determine the improvement of students' logical thinking skills, a single group experimental design with pretest-postest or one group pretest- postest design is used.

RESULTS

Observation Result of Learning Device Implementation

The main purpose of analyzing data on the implementation of learning devices is to see the extent of the practicality of using the device in the learning process. Observation data on the implementation of the device is obtained through observations made by the teacher as an observer. Based on the results of the analysis of observer observation data on the implementation of learning devices from 5 meetings. In assessing the applicability of the research, tabulating the data score of the observation results of the implementation of learning by giving a score of 1 for “Yes” and 0 for “No” where there are several aspects that are considered in the form of initial activities, core activities and final activities. The results of the implementation of this research can be seen in the table below:

Table 1 Summary of Validation Results of the Implementation sheet

No	Assessment aspect	Meeting 1	Meeting 2	Meeting 3	Meeting 4	Meeting 5
1	Initial activity	2	4	4	4	4
2	Core activities	7	9	9	11	13
3	Final activity	1	2	4	4	4
Activity steps implemented		10	15	17	19	21
Total number of activities		22	22	22	22	22
Percentage of implementation		45%	68%	77%	86%	95%
Category		Very less	less	enough	good	Very good

Based on Table 1, it shows that the category of the implementation of the learning tools used has increased from the first meeting to the fifth meeting. The highest percentage of learning implementation was 95% with a very good category at the end of the meeting.

DISCUSSION

Implementation of learning devices

As previously described that theoretically, the results of the assessment of experts in the field of education about the device using the Cooperative Model of Group Investigation Type have met the criteria of validity and have been feasible to use in class. While empirically based on the results of observations of the implementation of learning devices in the trial, it is stated that it meets the criteria very well.

From the test results, the highest score of 95% was obtained in the very good category. Based on the assessment criteria, it can be stated that the value is in the fully implemented category. Thus it can be concluded that the device developed has met the requirements of implementation. In the implementation of the trial, it was shown that each phase of the Cooperative Model of Group Investigation Type was able to be implemented well by the researchers. In addition, it appears that the device developed can direct students to interact with their friends, or interact with the teacher to complete tasks and conduct experiments, thus enabling the confidence of each student to understand the material provided while providing maximum learning outcomes. The implementation of learning devices can be seen from the results of teacher responses to learning devices.

In general, the description of teacher response in learning Cooperative Model of Group Investigation Type is in good or positive category. This shows that the learning oriented Cooperative Model Type Group Investigation and its

tools are responded well and accepted by observers (teachers). In terms of practicality, the Group Investigation Type Cooperative Model learning tools which include lesson plans, LKPD and Logical Thinking Ability Test are very practical to use because they have detailed activities carried out by teachers and students. This is in accordance with the opinion expressed by Gagna (in Wills, 2011: 20), that learning that is carefully prepared according to the correct steps will produce a good device.

CONCLUSION

Needs Analysis of Physics Learning Tools with Cooperative Model of Group Investigation Type, from the results of the study it was found that the need for physics learning tools with a cooperative model of group investigation type is very significant where this device makes it easier for teachers to create active and enjoyable learning for students with this device students become more active in expressing or having opinions in learning because in the learning tools accompanied by pictures and examples of problems that are easy to understand and can directly improve the logical thinking ability of students.

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