The application of guided discovery learning model to improve students concepts understanding

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Abstract. This study aims to determine the differences in understanding concepts of students between classes using guided discovery learning model and non-guided discovery in heat material and knowing the response of students in Public Junior High School 8 Banda Aceh. The populations in this study were all students in 7 year with the selection using purposive sampling, so student from grade seven-one and three were obtained as samples. Tests of understanding concepts students use multiple choice questions with five choices of answers. The test is used to determine the scores of students in the guided discovery and the non-guided discovery classes. The data of the research results were analyzed by t-test for understanding concepts and descriptive statistics for questionnaire responses. The results showed that: there were significant differences in increasing of understanding concepts between classes taught guided discovery and those taught with non-guided discovery model. The application of the guided discovery model improves student learning outcomes, especially in understanding the concept.

1. Introduction

Physics is a part of Science that is born and developed based on observations of facts in nature and produces concepts, principles, theories and laws of physics. Physics is also one of the subjects of the National Examination (NE). In many cases, it is always a subject that many parties complain about, especially students, as one of the difficult and frightening subjects. Students' perceptions influence their understanding and learning of the course. Many students think and say "physics is difficult" [1]. They said difficult because physics is concerned with so many formulas and numbers to memorize. Other difficulties come from the concepts of physics, the way in which physics courses are taught and physical problems that are sometimes very nebulous [2]. An interview with a physics teacher at Public Junior High School 8 Banda Aceh, explained that physics materials were classified as difficult, so the learning only used the lecture method. The learning focused on the teacher, while students only listened to whatever teacher said. Another factor, the students felt bored, because the learning was only applied in the classroom, and teachers rarely used science laboratory because of inadequately of facilities and infrastructure [3]. Even though, students were deployed to solve the problem so that they can develop their abilities in criticizing the problems they faced and were able to find possible solutions to solve the problem [4]. Students were not active in the classroom and they were less motivated in participating of learning so that they were difficult to solve the problem because of lack of understanding even with the
same concept. Though mastering the concept is a higher level of ability than just knowing a concept, but students must really be able to understand a concept that taught [5]. To improve the understanding of students in learning physics, various efforts are needed that can support the completeness of the achievement of learning goals. Preparation of teaching materials and implementation of learning process are the main abilities that must be possessed by a teacher in order to be able to manage learning activities creatively and innovatively. For this reason, it is necessary to develop an innovative learning model that can improve understanding concept of physics, increase motivation and escalate students’ creativity. Understanding is a form of knowledge or perspective of a person in seeing a problem [6].

Understanding of concepts in learning is a fairly serious problem in education. Based on reality shows that students only memorize the concepts that taught by the teacher, but they do not understand the utilization of the concept if they encounter the problems in real life so that students learning outcomes are unsatisfactory [7]. The difficulties come from the lack of understanding of teachers to appropriate learning model that is used for difficult topic. Because of in addition to the availability of facilities and infrastructure such as media, learning models also greatly help students to understand the concept [8]. To overcome the difficulties in understanding concepts and increasing motivation in learning physics, it is very necessary to apply learning models. Learning model that emphasize on students-centered in finding their concepts are with guided discovery model.

Guided discovery learning is a learning that trains and guides students to learn, gain knowledge, and build concepts that they find for themselves [9]. The guided discovery model is a model that used to build the understanding of concept of student under supervision of teacher which is a cognitive learning model that requires the teacher to be more creative in creating situations that can make students to be active in discovering their own knowledge so that they solve complicated and abstract concepts [10]. In guided discovery learning, students are directed to discover concepts. In this learning process, students are encouraged to think and analyze themselves, so that they can find concepts based on the material or data that has been provided. Thus, this model is very suitable to be applied in learning physics, so as to improve understanding of concepts and learning motivation of students. There was a significant difference in concept understanding between students who were taught with guided discovery models and those who were taught through non guided discovery learning on heat material [11,12].

2. Methods

The method used in this study was the Quasi Guided discovery method, with the form Nonequivalent Control Group Design. Quasi Guided discovery research involves two classes or two study groups, specifically as the guided discovery class and the non-guided discovery where the samples of the two classes are not randomly selected.

| Class | Sample | Pretest | Treatment | Posttest |
|-------|--------|---------|-----------|----------|
| E     | Y₁     | O₁      | Xₑ        | O₂       |
| K     | Y₂     | O₁      | Xₖ        | O₂       |

Information:
E : Guided discovery class
K : Non guided discovery
O₁ : Pretest given prior to treatment in the non-guided discovery and guided discovery class
O₂ : Posttest given after treatment in the non-guided discovery and guided discovery class
Rₑ : Treatment with the application of guided discovery learning model
Xₑ : Treatment with the application of non-guided discovery learning
Y₁ : Guided discovery sample
Y₂ : Control sample

This study was conducted in Public Junior High School 8 Banda Aceh academic year 2018/2019. The population in this research was all of students in 7 year, and the sample was chosen from grade
seven-one and three by purposive technique. Sample selection was done by selecting classes that have relatively homogeneous abilities in the two classes by looking at the results of the initial tests conducted in all classes. Data collection in this study used syllabus, lesson plan, student worksheets, pretest and posttest questions about understanding concepts. The test was used to determine the scores of students in the guided discovery class and non-guided discovery, and was given to students before and after learning activities with the same questions based on the topic taught, namely temperature and heat.

3. Result and discussion

3.1 Comparison of pretest and posttest values of non-guided discovery and guided discovery classes

The results of the comparison of pretest and posttest value of guided discovery learning and non guided discovery learning classes can be seen in the diagram in Figure 1.

![Figure 1. Comparison of understanding concepts non guided discovery and guided discovery class.](image)

The diagram shows that the pretest and posttest values of guided discovery learning class were superior to non-guided discovery class. All guided discovery class students scored 23.4% for the pretest and 85% for the posttest. With the difference in the increasing of understanding concepts between the guided discovery class and the non-guided discovery, it is certain that the increasing of understanding concepts of the guided discovery class is superior to the non-guided discovery [13]. Furthermore, by using guided discovery learning model, students were actively and responsibly in answering the problems given in a way actively discussing with peers in conducting experiments [14].

The non-guided discovery class students scored 22.3% for pretest and 70.3% for posttest. Increasing the value of students from pretest to posttest in the guided discovery class was higher than the non-guided discovery class. The non-guided discovery class students got low values because they only memorized the concepts that had explained by the teacher before, they did not find and prove the concepts by themselves. Most students learned only by memorizing concepts but did not know how the material can be applied to the real life. This is very synchronous with the reality, particularly in science lessons, especially physics [15]. Students are able to learn better when teaching methodologies allow them to be actively involved in classroom learning activities. Students as learners must actively participate in conducting learning (experiments), carrying out demonstrations, discussions class and other learning experiences [16]. The non-guided discovery method used in the teaching and learning process can result in a level of understanding and low thinking skills. In non-guided discovery learning, students were only tasked with remembering what the teacher had conveyed before, knowing the results of listening to the teacher's explanation, and conclusions obtained were also based on what had been concluded by the teacher [17]. Furthermore, based on observations made, the learning process is still
oriented towards completing tasks that had all been designed by the teacher. The dominance of teacher who was very strong had neglected the opportunity of students to be actively involved, creative and critical in learning [18].

3.2. Comparison of indicators of understanding concepts of guided discovery and non guided discovery class

The indicators of understanding the concept assessed between the non guided discovery and the experiment is interpreting, exemplifying, classifying, summarizing, concluding, comparing and explaining. The comparison table of indicators of understanding the concepts non guided discovery and experiment classes can be seen in Figure 2.

![Figure 2](image)

**Figure 2.** Indicators comparison of understanding concepts of control and experiment class.

Figure 2 showed that out of the 7 indicators assessed; only summarizing indicator had the same values between classes taught in the non-guided discovery and guided discovery learning. The same value of students between the non-guided discovery and guided discovery class on the assessment indicator was due to the learning process so far that many students spent by taking notes. This was because the teacher only involved the students with answering the questions "yes" or "no", noting and the they were not given the opportunity to discuss [19]. The large percentage of the value of understanding the concept of guided discovery class students is certainly not separated from the learning model used by the teacher [20]. Therefore, learning approach that is suitable to be applied in the classroom will be able to become one of the factors in the learning success of students both individually and in groups [21].

The high value of understanding the concepts of students in the guided discovery class was because with the guided discovery learning process they experienced namely mental experience and social experience. Mental experience is obtained from the sense of hearing and sight, information obtained based on what the sense of hearing derived from the explanation given by the teacher while the sense of sight came from the discovery of the student themselves [22]. Furthermore, the increased of understanding the concepts and critical thinking skills abilities in the guided discovery class was due to the learning model used, namely the guided discovery learning model that had a positive impact on students. The guided discovery learning model is able to give students the chance to be more active during the learning process. The learning process was not teacher-centered but on each student, students
were encouraged to find concepts and knowledge for themselves by conducting experiments in the laboratory [23]. Every learning process, students are required to think actively in asking and answering challenging classification questions, so that at the time of the posttest they already understand the concepts that are filled in the answer sheets [24]. Student selection shows that guided discovery provides a learning space for students to make decisions and form new learning competencies [25]. This is because physics is abstract because besides it is difficult there are some physics materials that cannot be seen with the five senses. Therefore, physics material needs to be presented properly so that students are able to understand the concepts taught by the teacher [26]. Positive responses of students showed that they liked the guided discovery model. One important thing in education is that students must be more active in learning activities themselves and not just listen to explanations from the teacher [27].

4. Conclusion

Based on the results of the research that has been done, it can be concluded that there is a significant difference in the increase in understanding of concepts between classes where students are taught guided discovery with classes taught by non-guided discovery classes on heat material. The average posttest understanding of the concept of non-guided discovery students is 70.3% and guided discovery classes are 85%.

Based on this study it can be stated that the application of the guided discovery model improves student learning outcomes, especially in understanding the concept. In addition, there are some suggestions for teachers to apply the guided discovery model in the physics learning process, because there have been several studies that prove that the model can improve learning outcomes. Also, research based on guided discovery model can be carried out by other researchers to review other matters.

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