ICEE-2

Effectiveness of Scientific Learning Guided Inquiry Devices Based on Real Media to Improve Understand Concept and Skills Process of Science Students

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Abstract. This study aims to develop a science learning device with a guided inquiry model which assisted by real media in improving students' conceptual understanding and science process skill. The research model uses the 4D (4-D Model) with the stages of define, design, develop and disseminate. Analysis of the results of the effectiveness using the N-gain equation shows that learning devices can improve students' conceptual understanding and science process skills in light material and optical devices. The average percentage of N-gain for students' conceptual understanding on each sub-materials: shadows on a flat mirror, the nature of shadows on curved mirrors, the nature of shadows on lenses, and optical devices was shown an increase in the percentage of N-gain. This was caused by guided inquiry models assisted by real media which make students directly conduct learning activities and observations. In the aspect of science process skills, the average N-gain in the aspect of predicting and applying concepts has a high N-gain value. The model which used in this research help students to find a concept through experiments and students were directly involved in finding solutions for the problems.

Keywords: Learning tools, guided inquiry, concept mastery, science process skills

INTRODUCTION ~ The implementation of education is an effort to realize the ideals of the nation's founders expressed in the 1945 Constitution (Sudiarman at al, 2015). The development of science has a positive impact on the development of the nation in the field of technology, so that the development of science and technology brings considerable benefits to humans (Nurmayani at al., 2018).

The implementation of education is not only students targeted at mastering the concept, but also have an ability in mastering the skills. Students also must have the ability to solve problems by using the process and principles of knowledge, in accordance with the learning objectives namely, learning to know and learning to do (Dewi at al, 2013), and learning to live together (learning to life together) (Prasetyono & Trisnawati, 2018). The learning process will be carried out well if the teacher facilitates and trains students.

One effort that has been made is to carry out learning using the guided inquiry learning model (Susilawati, 2015). Guided inquiry learning is effective for improving skills and understanding of concepts because the guided inquiry model has systematic steps, namely presenting questions or problems; making hypotheses; designing an experiment; conduct experiments to obtain information; collect data; and make conclusions (Eggen & Kauchak, 1996).

Learning with the guided inquiry model provides opportunities for students to discuss and work together to complete their assignments and be able to share

their responsibilities with the group's member (Maloney & Simon, 2007). The advantage of inquiry models is that the observation process can create a pleasant learning atmosphere and attract the attention of students so that they are motivated to learn (Sarwi at al, 2016).

The characteristics of the guided inquiry learning model are positioning the teacher as a facilitator in learning, and provide a large amount of guidance to students during the initial stages of learning, then the learner takes over greater responsibilities after they start to understand in solved the problem (Slavin, 2008).

The science process skills of students are strongly supported by the understanding of concepts which then become a foundation for students to do things that indirectly train their skills (Jamuri at al, 2015). The role of teacher as facilitator gives a bigger opportunity for student to build their own skill and conceptual understanding.

Skills development is the main thing to improve the process of science education. Those skills will make science education oriented to the formation of science process skills (Dewi at al, 2017). Learning model which is based on methods that can develop students' reasoning and scientific skills is called guided inquiry model. Through this learning model, students are directly faced to scientific activities.

The experimental stage in the guided inquiry learning model requires the creativity of the teacher to design a media. The use of instructional media helps students to practice in modifying and operating a tool. The media which must be used for supporting the learning process is called real media Susilawati, 2014); Basuki at al, 2015).

The use of media in the learning process cannot stand alone because the media is only used as a tool for learning. So it must be accompanied by learning model. The learning model that used in this study is a guided inquiry model assisted by real media.

METHOD

This research is part of a research development that examines the effectiveness of guided inquiry learning devices with the help of real media to improve science process skills and students' conceptual understanding.

Development is carried out using a 4D design development model (define, design, develop & disseminate) (Peranti at al, 2019); Wardani & Wiyatmo, 2018). The test of effectiveness was using the design of one group pretest - posttest. The research sample consisted of two classes, experimental class and control class from one of junior high schools in West Lombok. The experimental class was treated with guided inquiry learning model assisted by real media and the control class was treated with conventional learning model.

Before treatment, the two classes were given a pre-test with a conceptual understanding's instrument in the form of multiple choice and a science process skill in the form of description questions. After the treatment, students were given a final test. The improvement of student's conceptual understanding and science process skills were determined by the N-gain test using this equation (Sariah at al., 2018); (Suranti at al., 2017).

$$\text{N} - \text{gain} = \frac{S_{post} - S_{pre}}{S_{max} - S_{min}}$$

Which, S_{post} is posttest score, S_{pre} is pretest score, S_{max} is the highest score, and S_{min} is the lowest score. The results of the N-gain calculation were consulted with the N-gain table with the criteria g < 0.3 (low), 0.3 ≤ g ≤ 0.7 (medium), and g > 0.7 (high).

RESULTS

The results of the effectiveness test were obtained from the N-gain analysis.

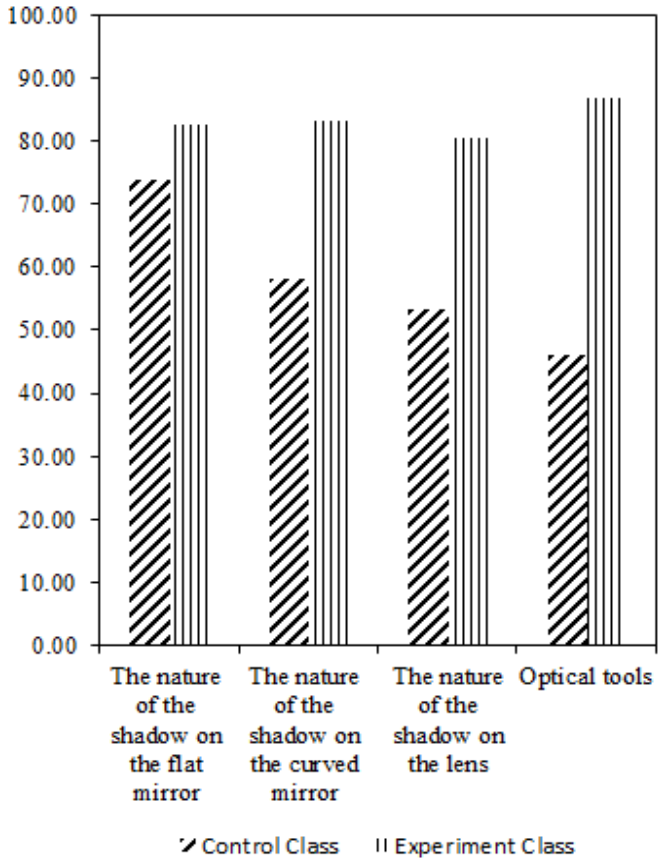

Figure 1. Comparison of the average percentage of student's conceptual understanding of each sub material.

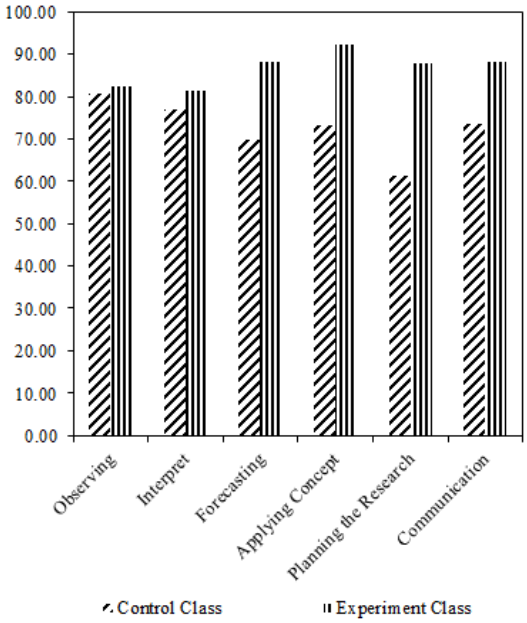

Figure 2. Comparison of the average percentage of each indicator of students' science process skills.

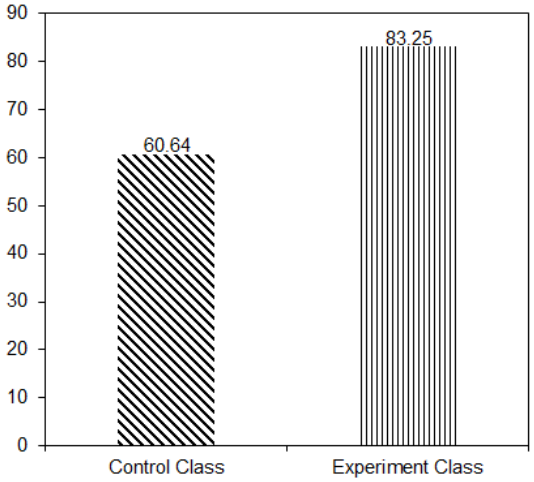

Figure 3. Comparison of the average percentage of students' science process skills.

DISCUSSION

Guided inquiry-based learning is learning that focuses on the intensive development of each instruction so that it is able to develop students' abilities in analyzing a problem provided by the teacher (Shea, & Bidjerano, 2010). According to (Akyol et al., 2009), the inquiry model successfully enabled the emergence of new ideas from students. In this study, the inquiry model which integrated with real media is able to increase students' conceptual understanding.

The improvement of students' conceptual understanding is shown on Figure 1. The score for each sub material on experiment class is higher than control class. Especially for sub-material optical tools, experimental class gets the highest score than the other. But for control class, the score on optical tools got the lowest one. This is caused by the used of guided inquiry model based on real media. Inquiry help student to

improve their skill on using equipment to equip their idea. (Garrison & Vaughan, 2013) also said that the phase of inquiry called integration help student in supporting their new idea.

Each sub material is at a different cognitive level. The nature of the image on a flat mirror is a sub material which categorized on C2 and C3, while the optical tool is at the cognitive level of C4. The percentage of N-gain in the experimental class gets the lowest score in the sub-material properties of the shadows on the lens and the highest in the optical material due to differences in the level of difficulty and the difference in treatments. The higher the cognitive level, the more difficult the problem to be solved (Suranti at al., 2017).

Learning carried out in the presence of real media makes the learning process run smoothly and students are actively involved in learning (Maulina & Kustijono, 2017). This is caused by the existence of real media that helps students to directly observe events related to optics, so that students are helped to not only imagine, but can see concretely (Yeritia at al., 2017). Conceptual understanding is obtained by generalizing several concepts in a certain pattern. Students must be able to analyze and evaluate a number of concepts in solving a problem (Yulianci at al., 2017).

In Figure 2, you can see the difference of average percentage scores between the experimental class and the control class. The control class got the highest score in the observation and communication indicators, while in the experimental class the highest score in the indicator applied the concept. The high percentage score was caused by students' learning experience with a guided inquiry model that assisted by real media. This model was very helpful for students to remember and explain the concepts, so they can solve problem well.

Guided inquiry learning helps students to gain a hands-on experience in experimental process, and assisted with teacher as guidance (Jannah at al., 2016). The free access for students to carry out experiments, can train their psychomotor abilities in conducting experiments in accordance with scientific principles so that students' scientific process skills become improved (Jannah at al., 2016).

The comparison of average percentage score in Figure 3 shows that the control class with a percentage of 60.64 is in the medium category and the experimental class with a percentage of 83.25 is in the high category. The percentage difference obtained due to student activity in the experimental class which is more active than the control class. Students in the experimental class participate in learning, doing experiments that help students build their own experiences which very memorable for them. The acquisition of experience is very helpful for students in solving more complex problems, with direct experience can also help students

develop their skills. So that, the guided inquiry models which assisted with real media can improved students' conceptual understanding and their science process skill.

CONCLUSION

The science learning device with the guided inquiry model assisted by real media has proven to be effective in improved students' conceptual understanding and science process skills. The improvement of conceptual understanding is showed by the average score of N-gain which in the high category for each sub-material. The improvement of students' science process skills was also shown by high average score of N-gain. The score for each indicator of science process skill also improved in experimental class. Real media which integrated on guided inquiry help students in participating directly on finding their own concepts through a proof.

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