The Use of Instrument to Measure Student's Understanding of the Concept of Light Refraction Using Animation Slide Show for Secondary School Students

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Abstract

The purpose of this study was to get an idea of the effect of the use of assessment instruments in the form of animation to test understanding of the concept of refraction of light. The method used is a quasi-experiment with design posttest only nonequivalent control group design. As a control group used items were in the form of paper and pencil tests. Study was conducted on a class X student of SMA Tanjungpinang in Provinsi Kepulauan Riau of academic year 2013/2014. Samples were selected two classes of seventh grade classes were randomly parallel, as a control group and experiment group. Sum of sample of 85 people with 42 people for a percentage of the control class and 43 people for classroom experiments. Data collected after the experimental class and control class equally get learning the refraction of light. Gain control class test in the form of paper and pencil test which amounts to about 20 numbers, and the experimental class to get the test in the form of the same animation and the number 20, numbers matter. The research instrument used was a questionnaire about the pretest and posttest design. Data analysis was conducted using inferential statistics using SPSS 17. Based on the results the average score of the experimental class 74% with a standard deviation of 14 and an average score of 31% control class with a standard deviation of 12. It can be concluded that the test results of students' understanding of the concept of refraction of light that gets items were significantly different in animated form compared to students who obtain items were in the form of paper and pencil test. Understanding students' test results in sub concepts Snell's law, a concave lens and a convex lens using items were in the form of animation is higher than the students who use the items were in the form of paper and pencil tests. Students agree with the use of items were in the form of animation on comprehension tests concept of refraction of light. Students stated that the items were animated very interesting, a better understanding of the issue in question, to understand the purpose and content of questions, and a description of the problem becomes clearer. The use of items was suggested in the form of animation to be developed on other concepts in physics learning.

Keywords: *Animation, Understanding concepts, Refraction of light*

1. INTRODUCTION

Assessment (assessment) as part of the learning program, has a very important role and provide benefits to the achievement of student learning outcomes. According Haryati [5] benefit assessment can be stated as follows: find out the strengths and weaknesses in the learning process, monitor students' progress, feedback for teachers to improve teaching methods, feedback for teachers to make instructional improvements

Computer media excellence in the ability to model a phenomenon in the form of simulation / animation can be utilized in the process of evaluation of learning outcomes. For issues related to the phenomenon of dynamical / motion, then the evaluation questions can be packaged in the form of animation. Research on the use of

assessment in the form of animation to measure understanding of physics concepts have been conducted by M. Dancy and Robert Beichner [2], the results showed that the assessment in the form of animation can enhance the understanding of the concept of student test results on Newton's laws of learning.

Refraction of light is one of the physics of matter that is often found in everyday life, such as when we see the bottom of the tub where the water is clear and calm will appear more shallow, as well as if it were a pencil in a glass of water that will appear on the fracture surface water. It is a symptom of refraction. Events describing the behavior of the refraction of light propagation through the field before and after the boundary of two or more different mediums. To assess student learning outcomes of understanding the concept of refraction of light is usually done using the questions in the form of *paper and pencil test* in the form of written questions in the form of graphics or static pictures. It cannot describe the incident light propagation so as to make it difficult for students to understand the actual events of the refraction of light. Therefore, it seems to assessment in the form of animated items were deemed more suitable to evaluate the understanding of the concept of refraction of light.

Based on the above background, the research has been done on the effect of the use of assessment (assessment) with the questions that are packed in the form of animation on the concept of refraction of light on the understanding of the concept of test results refraction of light, with the title "Utilization Assessment Instrument Form Animation To Promote Understanding Refraction of Light Concept For High School Students".

2. PROBLEM STATEMENT

How about the students' understanding of the concept of refraction of light materials between students who use the questions in the form of animation by students who get about in the form of static images?

3. OBJECTIVES AND SIGNIFICANT OF RESEARCH

The purpose of this study was to get picture of the effect of the use of assessment items were in the form of animation to test understanding of the concept of refraction of light, when compared with the use of assessment in the form of *paper and pencil test,*

This study is expected to provide empirical evidence about the effect of the use of assessment in the form of animated items were the results of tests of understanding the concept of refraction of light. The results of this study will be utilized by the various interested parties.

4. METHODS

Based on the goals to be achieved, this study used a quasi-experimental and descriptive methods. Experimental methods used to obtain test data understanding the concept of refraction of light, while the descriptive methods used to obtain data to assess student responses in the form of animation. The study design used is *equivalent non-posttest control group design Only* research that is conducted in two classes, one class of experimental and one control class. Both classes are given learning refraction of light with the same treatment that is a model of inquiry. After the class finished learning experiment and control classes given the ultimate test of understanding the concept of refraction of light with different forms of matter but the content is the same. Class experiments using items were in the form of animation while control classes using items were in the form of *paper and pencil test.* Experimental class students answer the questions by using a computer. To answer the questions students should see an animated display each answer choice. Answers can be given by clicking on one of the answer choices that they deem most appropriate. Animation that shows a process of light propagation in a medium, the refraction of light in two areas of medium and after passing through a medium.

Descriptive research is used to capture the response of students to use the assessment items were in the form of animation.

4.1. Population and Research Sample

Subjects in this study is one of the students of class X SMA Negeri 2 Tanjungpinang Kepulauan Riau 2013/2014 as much as two randomly selected classes of seventh grade class parallel. The samples were taken two classes of students at random, ie class X-2 by 43 students as the experimental class and class X-1 by 42 students as the control class.

4.2. Research Procedures

The first stage is the preparation done, which include; literature study to examine theories about assessment (assessment) using the questions in the form of animation and the theory of refraction of light, the preparation of teaching and research instruments and test and item analysis. The second stage is the implementation of research include; implementation of learning the refraction of light in both groups with the same treatment that the model of inquiry learning, disseminate to students and teachers problems understanding a concept that is packaged in the form of animations and ways to answer them with a computer, to test understanding of the concept of refraction of light after learning is completed by giving *the posttest* in the form of different questions. Grade students experiment with matter in the form of animations and control class students with the questions in the form of *paper and pencil tests* and questionnaires to the experimental class to solicit student responses to the use of assessment in the form of items were animated.

4.3. Data Analysis

The steps are performed on stage and data analysis include: scoring test understanding of concepts for the experimental class and the control class as a whole, to test the normality of data distribution, homogeneity of variance test data in the two groups. Test the research hypotheses using statistical analysis. After that perform data analysis questionnaire responses of students to the use of assessment in the form of animation.
Processing and data analysis using statistical test stages; The first, Test normality of data distribution to the data collected using *the Kolmogorov-Smirnov One Sample Test.* Secondly, the homogeneity of variance test was done to see two groups of equal variances least two independent variables, using the *Levene Test* [1]. Variance is said homogeneous if the data variance *posttest* experimental group together with the data variance *posttest* control group.

4.4. Research Instruments

The instrument used in this study are; The first is a test used to measure the concept of understanding the concept of refraction of light after understanding the learning process implemented. Tests understanding of concepts arranged in the form of multiple choice with five answer choices. Tests understanding of the concept for the experimental class is packed with the grain problem in animated form for the control class while items were packaged in a *paper and pencil test.* Animations are displayed each answer choice on the assessment in the form of animation used instead of a static image in a matter of *a paper and pencil test* to control class. The second is the Student Response Questionnaire used to solicit student responses to the use of assessment in the form of animation. This questionnaire using a Likert scale, each student was asked to answer a question with

an answer strongly agree (SS), Agree (S), disagree (D), and strongly disagree (STS). To the question positively associated with the value of SS = 4, S = 3, TS = 2 and STS = 1 and vice versa.

4.5. Test and result

The tests used in the research is a matter of understanding the concept of the test multiple choice with five answer choices. Before use, the instrument has been tested and *judgment.* Tests carried out to the students of class XI IPA 4 at SMAN 2 Tanjungpinang Kepulauan Riau. To find out about the quality of understanding of the concept of items were analyzed include: validity, reliability, and ease of distinguishing levels. Item analysis performed using *AnatesV4* program. The following provisions are described that are used for the analysis of the validity, reliability, level of ease, and distinguishing matter.

5. RESULTS AND DISCUSSION

Based on the above research problem, the research on assessment using the questions in the form of animation and the questions in the form of *paper and pencil test* to the understanding of concepts and student responses to assessment questions using animated on learning the refraction of light. The data obtained include; Data on test results of students on the topic of understanding the concept of refraction of light with matter in the form of animation and test data of students on the topic of understanding the concept of refraction of light with matter in the form of *paper and pencil test.*

5.1. Understanding Test Results Refraction of Light Concept

Percentage *posttest* mean score of students understanding the concept of refraction of light that gets the questions in the form of animations and students who get the questions in the form of *paper and pencil test* is shown in Figure 1.

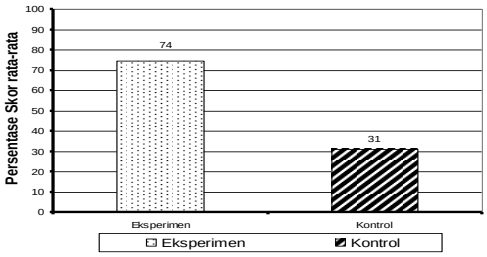

Figure 1. Diagram bar average percentage score *posttest* understanding of the concept of experimental class and control class

Based on the average percentage score *posttest* understanding of concepts such as in Figure 1, note that the average percentage score *posttest* experimental class students understanding of the concept of 74% of the ideal score, while the average percentage score *posttest* control class students understanding of the concept of 31% of the ideal score. The above data shows that the percentage of the average *posttest* scores of students who use the assessment in the form of animation is higher than the percentage of the average *posttest* scores of students who use the items were in the form of *paper and pencil test.*

5.2. Understanding the concept of t-test

After the students' understanding of the concept of data obtained experimental class and control class normally distributed and homogeneous then proceed to test the hypothesis by using parametric statistical tests (t-test with $\alpha = 0.05$). T-test results are summarized in Table 1.

Average *Posttes*		t	p	H_0
Experiment	Control			
19,33	8,10	15,027	0,000	Reject

Table 1. Summary of t-Test Results Average *Posttest* Differences Understanding Concepts

Statistical tests were performed using *the Independent Samples Test* result that the value of t = 15.072 at a significance of 0.000, as shown in Table 1. Significance value is less than the significance level of 0.05, which means that the hypothesis that there is no difference in the average scores understanding of the concept of significant tests between students who obtain items were in the form of animation by students who obtain items were in the form of *paper and pencil test* (H_0) is rejected. Rejection of the null hypothesis indicates a significant difference between the average test scores of students who gain understanding of the concept of assessment in the form of animation by students who received the assessment in the form of *paper and pencil test.* Average test results of students who gain understanding of concepts in the form of animated items were higher than students who get the items were in the form of *paper and pencil test.*

The average percentage score *posttest* understanding of the concept of refraction of light between the students who use the questions in the form of animations and students who get the questions in the form of *paper and pencil test* on the label concept Snell's Law, concave lens and convex lens can be seen in Figure 2.

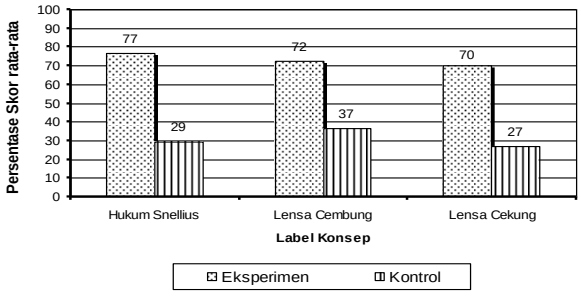

Figure 2. Diagram rods mean score on the *posttest* understanding of each concept label Snell's Law, concave lens and convex lens experiment class and control class

Acquisition *posttest* mean score of students in understanding the concept label Snell's Law for the experimental class by 77% and for grade control 29% of the ideal score. Acquisition *posttest* mean score of students in understanding the concept of a convex lens to label the experimental class by 72% and for grade control 37% of the ideal score. Acquisition *posttest* mean score of students in understanding the concept of a concave lens label for experimental class by 70% and for grade control 27% of the ideal score. From the analysis of the data on the students' understanding of each concept label is known that the average percentage score of *posttest* experimental class that uses the assessment in the form of animation is higher than the control class that uses the assessment in the form of *paper and pencil test.*

5.3. Discussion of different understanding of concepts through animation and *paper* test forms *and pencil test*

Statistical analysis of the data revealed that the understanding of the concept of students who take the test by using the animation better assessment than students with test *paper and pencil test.* The average score balanced understanding of the concept of students who take the test by using assessment in the form of animation is 19 and students who take *paper and pencil test* at 8. Results showed that the use of assessment tests in the form of animation used in assessing potential learning physics, in particular refraction of light on the subject matter.
Average *posttest* scores on the sub-concept of students' understanding of Snell's law for the experimental class was 77% and for grade control 29% of the ideal score. Acquisition *posttest* mean score of students in understanding the concept of sub-convex lens for the experimental class by 72% and for grade control 37% of the ideal score, and acquisition *posttest* mean scores on the students' understanding of the concept of a concave lens for a sub-class of experiments by 70% and for grade control 27% of the ideal score.
A better understanding of the concept of refraction of light through the animation tests according to various studies, namely the use of animation in teaching practicum. The use of media as a computer animation lab support, better at improving students' understanding of concepts and skills of the students and to motivate student learning [4]. The test results form the animation better understanding of the concept of the subject matter to a sub concept of light refraction Snell's law, a convex lens and a concave lens can be used to support the learning process. Tests with a form of animation that has the potential, can also complement some results of research on learning models that utilize devices such as computer simulation and the implementation of interactive multimedia learning model, so that weaknesses can be reduced.
Interactive multimedia-based learning model that utilizes the computer to further enhance the concept of geometrical optics than conventional learning [6]. Other research results reveal that the model of interactive multimedia learning can improve mastery of the concept of physical optical physics teacher [2]. Computer-based learning model is not reviewing the use of the test in the form of animation, particularly in light of the subject matter of habituation to a sub concept Snell's law, a convex lens and a concave lens. Therefore, the results of research into the use of animation on assessment of the subject matter to a sub concept of light refraction Snell's law, a convex lens and a concave lens is very important and needed in learning.

5.4. Discussion different understanding of each concept label Snell's Law, a concave lens and a convex lens between the experimental class and the control class.

The average score of students in understanding the concept of highest and lowest sub concepts Snell's law on the understanding of the concave lens. Sub concepts understanding concave lens should be greater than the students' understanding on Snell's law and sub concepts for learning convex lens concave lens after Snell's law of learning and learning convex lens. Average score highest understanding concepts should occur at the sub concave lens as the subject matter of Snell's law is a prerequisite or concepts underlying sub concepts convex lens and a concave lens.
Understanding the concept of refraction of light which consists of three sub-concepts above can be grouped into several types of knowledge. Type the knowledge in question is conceptual knowledge is knowledge about the relationship between the main parts of a larger structure that indicated the existence of the section as a whole functions. Procedural knowledge is knowledge of how to do things like thinking methods, criteria, techniques and methods [3]. Snell's law can be categorized in conceptual knowledge, while sub concepts convex lens and a concave lens can be categorized as procedural knowledge. Procedural knowledge about sub concepts convex lens and a concave lens that requires an understanding of the conceptual knowledge of Snell's law can serve as the cause of the average score understanding sub concepts convex lens and a concave lens is smaller.

Average sub concepts understanding of Snell's law is higher than the understanding of sub concepts convex lens and a concave lens suggests that understanding the fundamental concepts that are low-level thinking skills of students in higher level thinking skills does not guarantee higher would be better. Tsaparlis and Zoller [7] states that the performance of students in low-level cognitive abilities *(Lower-Order Cognitive Skill / LOCs)* are high does not guarantee the high mastery of high-level cognitive abilities *(Higher-Order Cognitive Skill / HOCS).*

Differences mean difference score of understanding on the concept of sub Snell's law, a convex lens and a concave lens between the experimental class with a grade control, respectively for 48, 35, and 43. Difference shows that the average students' understanding of Snell's law is relatively more well with the highest difference between the experimental class and control class than on understanding sub concepts convex lens or a concave lens.

Differences mean difference score of understanding on the concept of sub-convex lens between the experimental class and the control class, should be greater than the difference in the students' understanding of sub concepts Snell's law. Differences mean difference score highest understanding should be at a sub-class concept concave lens between the experimental and control classes. This is related to the subject matter of Snell's law is a prerequisite or concepts underlying sub concepts convex lens and a concave lens. Factors causing differences in the average difference Snell's law students' understanding of the higher between the experimental class and control class than on understanding sub concepts convex lens or a concave lens is different of the percentage of questions that difficult.

Understanding of the concept of assessment instruments in the form of animation in the experimental group consisted of 26 items. Items that measure students' mastery of the concept of Snell's law as many as 14 items categorized by the percentage of items that are difficult by 14% or only 2 items. Items that measure students' mastery of concepts about sub concepts convex lens by 8 items categorized by the percentage of items that are difficult to as much as 3 items with a percentage of 37%. Items that measure students' mastery of concepts about sub concepts convex lens by 4 items are categorized by the percentage of difficult items as much as 1 item with a percentage of 25%. Items other assessment instruments including moderate difficulty level category.

Understanding of the concept of assessment instruments in the form of *paper and pencils tests* in the control group consisted of 26 items. Items that measure students' understanding of the concept of Snell's law as much as 14 items categorized by the percentage of items that are difficult, also at 14% or just as much as 2 items. Items that measure students' understanding of the concept of sub concepts convex lens by 8 items categorized by the percentage of items that are difficult to as much as 2 items with a percentage of 25%. Items that measure students' understanding of the concept of convex lenses sub concepts by 4 items are categorized by the percentage of difficult items as much as 1 item with a percentage of 25% as well. Items of assessment instruments other forms including *paper and pencils test* medium difficulty level category.

The mean difference score students' understanding of Snell's law is higher between the experimental class and control class than on understanding sub concepts convex lens or a concave lens due to the percentage of the number of items categorized difficult assessment instruments with higher percentages respectively 37%, 14 %, and 25%. The percentage of items that are categorized different difficult this affects students' scores on the assessment results [8].

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

Based on the research that has been conducted on the effects of the use of assessment in the form of animation on student understanding of the concept of refraction of light on the topic, it can be concluded that; First, the score test students understanding of the concept of refraction of light that gets in the form of animated items

were significantly higher compared with the results of the test scores of students who gain understanding of the concept of the grain problem in the form of *paper and pencil test.* Second, understanding test results on each label concept Snell's law, a convex lens and a concave lens that uses the grain problem in the form of animation is higher than the students who use the items were in the form of *paper and pencil tests.* Thirdly, the use of the grain problem in the form test animation on understanding the concept of refraction of light getting positive responses (agree) of the students. Students stated that the problems can be animated provide an overview of the issues in question, to understand the purpose and content of questions, and a description of the problem becomes clearer.

6.2. Recommendation

Based on the research and discussion about the assessment that has been done using animated questions on learning the refraction of light, the researchers advise that; First, test understanding of the concept of refraction of light in the form of animation should be used by teachers in assessing the success of the learning process. Second, the study was conducted without reviewing the learning model used, preferably with continuous reveal the exact learning model with using assessment in the form of animation.

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