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Application of discovery learning model assisted by relativity chart media to improve students' scientific reasoning ability

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ABSTRACT

Students are not only required to be able to work on and solve a problem but also need to build hands-on and minds-on abilities including scientific reasoning. In fact, there are still many students who lack scientific reasoning abilities. There are many learning media, one of which is graphic learning media, in this study the graphic media used was Began Relativity with the Discovery Learning learning model. The purpose of this research is to find out whether there is an increase in learning using the Discovery Learning model with the help of the relativity chart media with learning using conventional learning models. The method used in this research is a quasi-experimental Noneqiuvalent Control Group Design. This research design uses pre-test and post-test from each group. The results obtained from this study are an effective increase between the use of discovery learning methods assisted by the Relativity Chart media with conventional learning methods to improve students' scientific reasoning abilities in Einstein's special relativity material, this can be seen from the results of the Normal Gain (N-gain) test.

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1. INTRODUCTION

Physics is a branch of natural science that studies phenomena, events and natural phenomena (Bachtiar, 2017). The purpose of studying physics is to develop knowledge and skills in analyzing the natural environment which requires an understanding of concepts related to the science studied in physics. One of the topics of physics is relativity, a field that measures where and when events occur and how far apart two events are in a given space and time (Halliday, 2010). The basic part of studying physics is the ability to master concepts. The results of interviews between teachers and students showed that students had difficulty in connecting between understanding concepts and the results of investigations. Lack of scientific reasoning ability is often found in students so that it affects learning and students' interest in physics. Scientific reasoning in learning activities is needed because it allows someone to solve problems well. In solving these problems, it is necessary to have rules that are owned by these concepts.

Because the concept is an abstract idea that allows someone to be able to group objects or events that occur.

The problem faced by teachers today is that students' mastery of scientific reasoning on Einstein's special relativity material is still relatively low. this is supported by the results of a limited interview from a physics teacher at an Aliyah school, Carenang sub-district. With the results of these interviews, it can be concluded that students have difficulty understanding the concept of Einstein's special relativity and reasoning scientifically on the material, because this material is abstract so that students are easily fooled when there are more complicated questions.

In fact, there are still many students who lack scientific reasoning abilities. So teachers need to use learning media to facilitate learning activities in class and learning models that are suitable with learning media to meet the needs of achieving learning objectives. Students will be more interested and have more opportunities to pay attention to what is explained. There are many learning media, one of which is graphic learning media. Graphic media is a visual media that presents facts, ideas or ideas through the presentation of words, sentences, numbers, and pictures or symbols. Graphic media has the potential to be suitable as a learning accompaniment tool for Einstein's special relativity material, because usually this graphic media is used to attract attention and clarify ideas and illustrate facts so that they can attract the attention of students.

Based on the description of the background of the problem above, to get success in improving students' scientific reasoning on Einstein's special relativity material, it is necessary to conduct research on "Application of the Discovery Learning Model Assisted by Relativity Chart Media to Improve Students' Scientific Reasoning Ability". Researchers used the Discovey Learning model as a learning medium and relativity charts as a learning aid. Discovery learning is a teaching method whose goal is to make students able to organize their own concepts or problems. Where the teacher makes a problem that raises the thinking ability of students to the problem and draws final conclusions (Abidin, 2013: 175). Discovery learning is intended so that students can understand the material as well as possible and learning will be more meaningful, so that the desire to learn will increase in students, because this model in the process uses activities and experiences directly so that it will attract the attention of students (Rosania, 2016). So from some of these understandings the discovery learning model is a problem-solving model whose process is not directly obtained from the teacher's explanation, but there is a need for in-depth problem solving for students either by researching or finding solutions to the problem before drawing final conclusions.

Purwarto, (2017) Media charts are "presenting difficult concepts that can be more easily absorbed by students" this is because charts are able to provide a summary of the important details in a presentation. So in this case the media chart can be a tool for the learning process so that students are able to understand and accept learning material.

Based on the description above, it can be seen that the chart media is a viewing medium that has many variations that have an important basic arrangement of information which contains writing, numbers, symbols and examples of information whose size can be adjusted to their needs. According to Shemer (2002) scientific reasoning is a set of methods designed to describe and interpret observations or infer phenomena, past or present. Reasoning is the process of drawing conclusions from principles and evidence to make new conclusions (Lawson, 2004). Nugraha (2017) suggests that scientific reasoning includes the ability to think involved in investigations, experiments, evaluating evidence, inference, from the whole pattern of reasoning usually includes hypothetico-deductive sub-patterns and several parts of the pattern,

which can be detailed as formal operational schemes such as combination properties. and correlation (Lawson, 2004). From the several conceptual definitions of scientific reasoning, scientific reasoning is an activity where one can conclude new concepts from principles and evidence previously studied or observed.

Special relativity deals with frames of reference that move uniformly relative to other frames of reference. Special relativity is notoriously difficult for students. Actually this relativities is not difficult in terms of mathematics, but this material is difficult in interpreting about who measures what, about an event and how the measurement is made, this is something that needs to be considered and must be defined carefully. Based on the background of the problem above, the research problem can be formulated as follows: (1) What is the profile of scientific reasoning abilities in the two groups using the discovery learning model with the aid of chart media and those using the conventional model? (2) How is the learning effectiveness of the two groups in the discovery learning model with the help of chart media with the conventional model?
Based on the formulation of the problem that has been mentioned, the objectives to be obtained in this study are: (1) To find out what is the profile of scientific reasoning abilities in the two groups using the discovery learning model assisted by chart media and those using the conventional model. (2) To describe how the learning effectiveness of the two groups in the discovery learning model assisted by media charts with the conventional model is.

2. METHOD

The method used in this research is quantitative research where this method is used to determine whether there is an effect of the independent variable on the dependent variable. This research belongs to the type of quasi-experimental Noneqiuvalent Control Group Design. The procedure for implementing this research design used a pretest and posttest to determine the initial state of the control class and the experimental class and to give different treatment for each group. The first group is a group whose learning process uses learning media in the form of chart media as an experimental class, while the second group is a group that in the learning process uses simple media as a control class.

Researchers determined that all students of class XII IPA in one Madrasah Aliyah, Carenang district, kab. Attack as the research population. Based on the population that has been determined as the research population, the researchers used students of class XII IPA 1 and class XII IPA 2 with a total of 30 students per class as research samples.
From these problems the author tries to provide a solution by applying graphic learning media in the form of charts. This relativity chart has an advantage over other charts, this is seen from the point of view of its use in appearance, this chart is prepared using magnets in which each element has a subject matter which will later be attached to the framework of the chart. In addition, this chart can be said to be practical in its use because teachers can easily use it wherever and whenever this relativity chart is needed.
The following is the flow of the framework of thinking that the researcher designed:

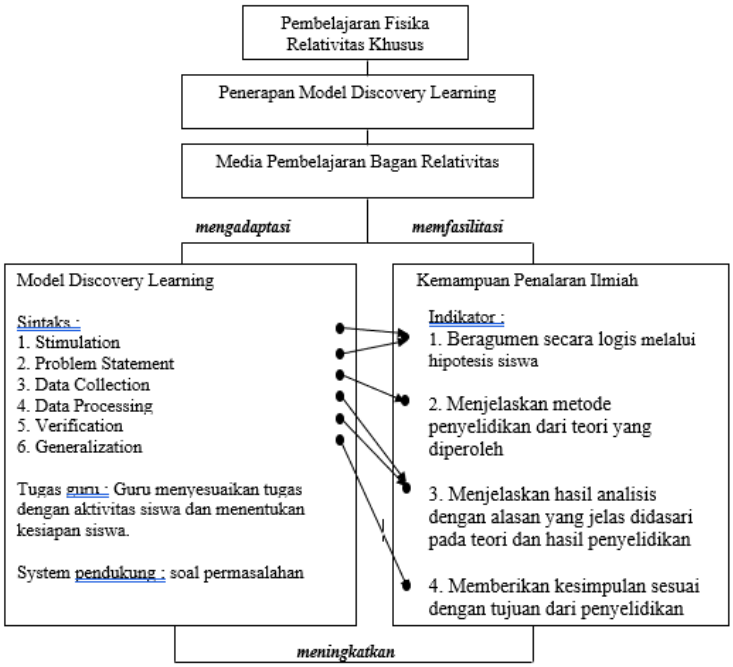

Figure 1. Research minded framework flow

The instruments used in this study were tests and non-tests such as worksheets and observation sheets. This test is given to measure the ability to understand scientific reasoning after following the learning process, while non-test is used to find information related to this research. To obtain research data, tests were carried out in the form of Pre-Test and Post-Test and tested using the N-Gain test to determine the effectiveness of using the learning model.

This N-Gain calculation is carried out to determine whether there is an increase from pre-test to post-test, with the following formula:

$$N - Gain = \frac{Skor\ Posttest\ -\ Skor\ Pretest}{Skor\ Ideal\ -\ Skor\ Pretest}$$

$$N - Gain\ Persen\ =\ 100\ x\ N - Gain$$

Category of N-Gain Score:

Table 1. Distribution of Score Gain

N-Gain Value	Category
g > 0.7	Height
0.3 g 0.7	Medium
g < 0.3	Low

Source: Malzer in Syahfitry, 2008

In addition to the N-Gain Test in this study, the t-independent test was also carried out on the N-Gain score. This aims to determine whether there is a significant difference between the Discovery Learning method with the help of the relativity chart media and the conventional Learning method. In the calculation of the independent t-test, the researcher uses assisted applications in the form of IBM SPSS Statistics 25 and Ms.

Excel 2019 as a supporting medium in statistical calculations.

3. RESULTS AND DISCUSSION

Pre-Test

The pre-test was carried out for two classes, namely class XII IPA 1 and XII IPA 2. The average of the results of the pre-test of the experimental class was 65.8 and the average of the results of the pre-test of the control class was 64.8667. The maximum value of the experimental class pre-test results is 75 and the control class is 79 for the minimum value of the experimental class pre-test results is 58 and the control class is 50.

Post-Test

The post-test was administered to two classes, namely class XII IPA 1 and XII IPA 2. The average post-test result for the experimental class was 85.033 and the average post-test result for the control class was 72.633. The maximum value of the post-test results of the experimental class is 92 and the control class is 83 for the minimum value of the post-test results of the experimental class is 80 and the control class is 65. For both the experimental and control classes, the results of the pre-test and post-test were graphed as follows :

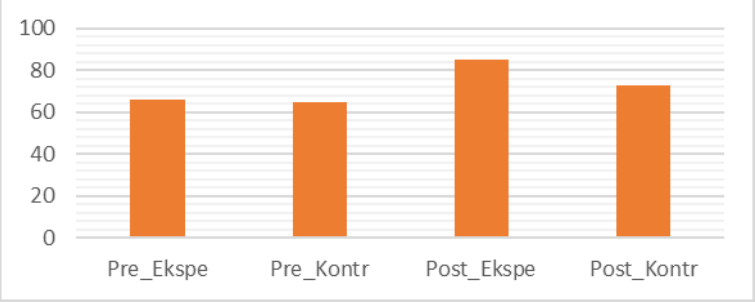

Figure 2. Pre-Test and Post-Test Results

After the research data is obtained, the next action is to analyze the data in this study using the normal-gain test. Where the normal-gain test is the difference between the post-test score and the pre-test score. After the data was collected to determine the improvement that occurred before and after the treatment in this study, the examiner used the normal-gain test using the Excel 2019 application and obtained the following results:

Table 2. Calculation results of N-Gain score

No	Class Eksperimen	Class Kontrol
	N-Gain Score	N-Gain Score
1	0,56	0,22

Supported from the teacher and student interview sheets, the results of the evaluation of each meeting have increased, it can be said that the learning method using Discovery Learning media with the help of relativity charts can improve students' conceptual understanding and scientific reasoning abilities in class XII Science 1 and 2 students. Supported from the teacher and student interview sheets, the results of the evaluation of

each meeting have increased, it can be concluded that the learning method using Discovery Learning media assisted by relativity charts can improve students' conceptual understanding and scientific reasoning abilities in students of class XII Science 1 and 2. To find out more The researcher took the data using Pre-test and Post-test.

The post-test is carried out the same as the pre-test, which is to determine the students' abilities about Einstein's special relativity material after being given treatment, in this case the treatment given to each class. The experimental class was given treatment in the form of a discovery learning learning model where this media can help students be active in class and improve students' scientific reasoning abilities, in this study using relativity chart media as a media to help the learning model to achieve research objectives. The post-test that is given is in the form of essay questions and has a total of 10 items. This post-test questions measures students' scientific reasoning abilities.

This research was conducted to determine whether there is an increase in scientific reasoning ability in the discovery learning method assisted by relativity chart media with conventional methods on Einstein's special relativity material. So in this study, the normal-gain test was used to analyze the research data that had been obtained. In this N-Gain test, the experimental class N-Gain value of 0.56 is included in the medium category with a minimum N-Gain Score of 80 and a maximum of 92. Meanwhile, for the average value of the control class, the value of 0.22 is included in the control class. low category. With a minimum N-gain score of 65 and a maximum value of 83. From the results of the descriptive analysis, there are differences where the experimental value is better than the control value, this affects the learning model given.

Because previously the two classes studied using the usual learning method and without providing learning media as a helper for students to capture or receive material when the teacher explained the material while relativity material was included in material that was difficult for students to understand. The use of this relativity chart media also helps improve students' understanding, supported by the results of interviews with several students and physics teachers who felt the impact of this research.

In addition, the discovery learning model is also suitable for training students' thinking skills, making students more active in class and also improving students' reasoning abilities. This is supported by the results of the evaluation of each stage of the study where each student meeting experienced a good increase. From the results of the data analysis above, it is in accordance with the framework of thinking that the discovery learning model assisted by the relativity chart media can improve students' scientific reasoning abilities in the experimental class against the control class using conventional models.

4. CONCLUSION

Based on the results of research and analysis conducted, it can be concluded that: (1) The application of discovery learning learning models assisted by relativity charts can improve students' scientific reasoning abilities on Einstein's special relativity material. This conclusion is based on the results of the N-gain test calculation where the results of the calculations show an increase in students' scientific reasoning abilities. (2) The use of discovery learning learning models assisted by relativity charts in improving students' scientific dosing abilities on Einstein's special relativity material is effective because the results of the n-gain test calculations on students' reasoning ability tests found the results of calculations with experimental class n-gain values 0.56 is in the medium category and

the n-gain value for the control class is 0.22 is in the low category when compared to the results of the two calculations, the experimental class is more effective than the control class.

REFERENCES

Abidin, Yunus. 2013. Pembelajaran Bahasa Berbasis Pendidikan Karakter. Bandung : Refika Aditama.

Bachtiar. (2017). Program Studi Pendidikan Fisika FKIP Universitas Jember, Indonesia. Vol. 6, No. 1.

David Halliday dkk. 2010. Fisika Dasar Edisi 7 jilid 3. Jakarta : Penerbit Erlangga.

Lawson, A. E. (2004) The Nature and Development of Scientific Reasoning: A Synthetic View. International Journal of Science and Mathematics education, 2(3), 307-338. http://doi.org/10.1007/s10763-004-3224-2.

Nugraha, M. G., Kirana, K. H., Utari, S., Kurniasih, N., Nurdini, N., & Sholihat, F. N. (2017) Problem Solving-Based Experiment untuk meningkatkan keterampilan penalaran ilmiah mahasiswa fisika. Jurnal penelitian dan pengembangan Pendidikan fisika, 3(2), 137-144. https://doi.org/10.21009/1.03203

Purwanto, B., & Smp, I. X. (2017). Pengaruh media visual grafis terhadap pencapaian pembelajaran fisika. 1–6.

Rosarina, G., Ali Sudin., & Atep Sujana. (2016). Penerapan Model Discovery Leasrning untuk Meningkatkan Hasil Belajar Siswa pada Materi Perubahan Wujud Benda. 1(1), 373-374.