



The Effect of Phet Simulation Media on Critical Thinking Ability and Learning Outcomes of SMA Negeri Yokiwa

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Abstrak

Penelitian ini bertujuan: (1) Mengetahui pengaruh pembelajaran menggunakan media simulasi *Phet* terhadap kemampuan berpikir kritis peserta didik SMA Negeri Yokiwa. (2) Mengetahui pengaruh pembelajaran menggunakan media simulasi *Phet* terhadap kemampuan hasil belajar peserta didik SMA Negeri Yokiwa. (3) Mengetahui pengaruh pembelajaran menggunakan media simulasi *Phet* terhadap kemampuan berpikir kritis dan hasil belajar peserta didik SMA Negeri Yokiwa. Pengumpulan data dengan menggunakan instrument angket dan tes. Hasil penelitian menunjukkan bahwa dalam pembelajaran menggunakan media simulasi *Phet* terhadap kemampuan berpikir kritis, terdapat perbedaan yang terlihat dari meningkatnya peserta didik yang kritis dalam pola pemecahan soal-soal fisika materi Hukum Ohm dan rangkaian Hambatan. Serta terdapat perbedaan hasil belajar antara sebelum pembelajaran dengan setelah pembelajaran. Terlihat hasil belajar setelah diterapkannya simulasi *Phet* lebih tinggi, ini menandakan bahwa terdapat pengaruh yang signifikan terhadap pembelajaran menggunakan media simulasi *Phet*. Pada hasil pengolahan data uji linearitas diketahui bahwa data berpola linier antara pembelajaran menggunakan media simulasi *Phet* (X) terhadap kemampuan berpikir kritis (Y1) dan hasil belajar peserta didik (Y2) di kelas XII SMA Negeri Yokiwa. Hal ini ditunjukkan nilai *deviation from linearity sig.* > 0,005 maka ada hubungan yang linear secara signifikan antara variabel *independent* dengan variabel *dependent*.

Kata Kunci: Simulasi *Phet*, Berpikir Kritis, Hasil Belajar

Abstract

This study aims: (1) To determine the effect of learning using Phet simulation media on the critical thinking skills of Yokiwa State High School students. (2) Knowing the effect of learning using Phet simulation media on the learning outcomes of Yokiwa State High School students. (3) Knowing the effect of learning using Phet simulation media on critical thinking skills and learning outcomes of Yokiwa State High School students. Data collection using questionnaires and test instruments. The results showed that in learning using Phet's simulation media on critical thinking skills, there were differences that could be seen from the increase in critical students in the pattern of solving physics problems on Ohm's Law material and the series of Barriers. And there are differences in learning outcomes between before learning and after learning. It can be seen that learning outcomes after the implementation of Phet simulation are higher, this indicates that there is a significant effect on learning using Phet simulation media. From the results of linearity test data processing, it is known that the data has a linear pattern between learning using Phet (X) simulation media on critical thinking skills (Y1) and student learning outcomes (Y2) in class XII SMA Negeri Yokiwa. The deviation from linearity sign indicates this. > 0.005 then there is a significant linear relationship between the independent and dependent variables.

Keywords: *Phet Simulation, Critical Thinking, Learning Outcomes*

Introduction

Education has an essential role in the process of developing a nation. The world of education is expected to provide professional human resources to advance the country with its science and technology. Article 1 of the National Education System Law Number 20 of 2003 concerning the National Education System affirms that education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual

strength, self-control, personality, intelligence, noble character, and skills needed by himself, society, nation and state. Learning is an interaction process between students and educators and learning resources in a learning environment. Article 3 of the Law on the National Education System Number 20 of 2003 confirms that national education functions to develop capabilities and shape the character and civilization of a dignified nation in the context of educating the nation's life, aiming at developing the potential of students to become human beings who believe and fear God Almighty. One has noble

character, healthy, knowledgeable, capable, creative, independent, and a democratic and responsible citizen.

The learning process is a system that has several components, including objectives, materials, media, methods and evaluation. Thus, several factors influence the learning system, including educators, students, infrastructure, etc. One of the factors that are considered to affect the learning system significantly is the educator factor. This is because, educators are the spearhead who deal directly with students as subjects and objects of learning. In line with the development of science, technology and environmental changes, education should also experience development, therefore the education curriculum should also experience consequences adapted to conditions. Physics is a science that develops from observing natural phenomena and the interactions that occur in them. Physics as a collection of knowledge can be in the form of facts, concepts, principles, laws, theories, and models. Physics as a way of thinking is an activity that takes place in the minds of people involved in it because of their curiosity and desire to understand natural phenomena. And also as a way of investigating how scientific information is obtained, tested, and validated. Learning physics is a science that must be learned through direct observation. So that students can understand the material presented by educators and student results can achieve more significance than the KKM standard. Learning outcomes are abilities obtained by individuals after the learning process, which can provide behavioural changes in the knowledge, understanding, attitudes, and skills of students so that they become better than before. The low learning outcomes that are less than the KKM standard for each subject are caused by several factors, from educators, students, and other factors that cannot be controlled. From the factor of educators, it is possible that they have not used a tool or media that can be integrated in all teaching and learning activities and requires educators to be more creative in implementing the KBM process.

In this modern and sophisticated era, information and communication technology is needed in every life. The rapid development of ICT has changed the lifestyle of today. Dissemination of information with methods that apply technology, such as promotions, news, learning, games and others, can be accessed through computers and smartphones. ICT-based education is a means of interaction that educators, education staff, and students can use to improve the effectiveness, quality, productivity, and access to education in Indonesia. Technology and scientific development affect new learning strategies and model opportunities, including science learning in secondary schools (Sulisworo in Wiravanjava, 2017). Information and Communication Technology can create a learning media, at first the media were only considered teaching aids for educators. The tools used are visual aids, such as pictures, models, objects and other devices that can provide concrete

experiences and motivation to learn and enhance students' absorption. One learning media that can be used in physics learning is the interactive PhET Colorado simulation. The interactive PhET Colorado simulation is the creation of the PhET Project science community at the University of Colorado, USA. PhET Colorado interactive simulation is a fun interactive simulation-based learning media with the concept of discovery. This simulation is in the form of software that can clarify physical concepts or phenomena to be explained. PhET simulation is an interactive learning media that provides opportunities for students to learn the material at any time, can be repeated until they understand the concept, guide, and inspire to experience the learning process independently, understand natural phenomena through scientific activities, and imitate the workings. Scientists in finding invisible facts, concepts, laws or principles of physics (Miftah, 2019).

PhET simulation provides tools and materials used in demonstration activities or experiments. In addition, using PhET simulations can make learning a discovery process characteristic of physics learning. The use of technology in physics learning is more productive than traditional methods such as lectures. Meanwhile, based on the experience and observations of the author when teaching. Researchers assume learning physics in high school is still not optimal. The indicator is the low achievement of students' physics learning outcomes. The data on the average physics value of students in class XI Yokiwa Public High School, Sentani Regency, has not yet reached the standard of completeness, even though the middle of totality in studying physics is 70. The grades of students in class XI Yokiwa Public High School, Sentani Regency in the academic year 2014/2015, 2016/2017 and 2017/2018 respectively, were 65.57 and 68. This was due to students' lack of motivation in learning, the inappropriate selection of media used by educators and the less optimal use of the physics laboratory. In addition, the lack of interaction between educators and students, students and students, so efforts to increase students' absorption are not achieved. The learning process centred on educators causes students to be less active and not enthusiastic in participating in the learning process, students only accept what is given by the teacher. The problems mentioned above cause students' physics learning outcomes to be low. One innovative learning media that is now widely used is the PhET simulation media. A team developed this media from the University of Colorado United States to help students understand visual concepts.

PhET simulation brings the invisible to life through graphics and intuitive controls such as click and drags manipulation, sliders and radio buttons. All PhET simulations are available for free at <http://phet.colorado.edu/en/get-PhET/full-install>. Besides being easy to use and apply in the classroom, PhET can also be used online at <https://PhET.colorado.edu>. PhET requires

a computer with Java and/or Flash installed. The advantages of the PhET simulation are that it can be used as a strategy that requires involvement and interaction with students, educates students to have constructivist thinking patterns, invites students to be able to combine their initial knowledge with virtual findings from the simulation that is run, making learning more interesting. This is because students can learn and play on the simulation and visualize physics concepts in the form of models. Through the PhET simulation media, which provides interactive physical media simulations and invites students to learn to explore directly, it is hoped that students will be more accurate in studying a material, especially physical phenomena. That way, students are more interested and active in learning and can increase their motivation and interest. Based on this explanation, it is necessary to research "The Effect of Phet Simulation Media on Critical Thinking Ability and Learning Outcomes of Class XII Students at SMA Negeri Yokiwa".

Method

This study uses quantitative methods. The quantitative method is called the traditional method, because it has been used for a long time and has become a tradition for research. This method is called the positivistic method because it is based on the philosophy of positivism. This method is a scientific/scientific method because it has complied with scientific principles, namely concrete/empirical, objective, measurable, rational, and systematic. This method is also called the discovery method because, with this method, various new science and technology can be found and developed. This method is called the quantitative method because the research data is in the form of numbers and the analysis uses statistics (Sugiyono, 2011).

Data Analysis Technique

Instrumental analysis test

1. Validity Test

A valid instrument means that the measuring device used to obtain the data is valid. Valid means that the tool can be used to measure what is to be measured (Sugiyono, 2011).

2. Reliability Test

According to Sugiyono (2010), reliability shows that an instrument can be trusted enough to be used as a data collection tool because the instrument is good.

3. Test N-gain

Categorization of the gain index value obtained by students is done to see the increase in mastery of concepts before and after learning

Prerequisite Test

1. Data Normality Test

The normality test of the data is used to determine whether the information is typically distributed. This study is to determine whether the data is normally distributed or not.

2. Correlation Test

The type of correlation test used in this study is a simple correlation with a simple correlation test with the Pearson product-moment correlation test, the researcher uses a correlation test because this test can determine the degree of relationship between the independent variable and the dependent variable.

3. Regression Test

The type of regression test used in this study is a simple regression test. It uses this analysis to predict the dependent variable Y if the independent variable X is known.

4. Linearity Test

The linearity test determines the linear relationship between variables, meaning that parallel changes will follow any changes that occur in one variable in other variables.

Results and Discussion

Based on the data from the calculation of N-gain, the increase in student learning outcomes on ohm's law and resistance circuits, it is obtained that the N-gain is in the medium category. So learning Phet simulation media is good to use to improve the learning outcomes of class XII students of Yokiwa State High School.

Analysis of the normality test of the questionnaire data and the test was used to determine whether the data were normally distributed or not. Based on the results of normality analysis obtained, sig. for the x variable is more significant than 0.05. The phet simulation questionnaire instrument for students in critical thinking is usually distributed, and the results of the y variable are less than 0.05. The test instrument is normally distributed.

Based on the hypothesis testing, there is a significant relationship between Phet (X) simulation media on critical thinking (Y1) and student learning outcomes (Y2) in class XII SMA Negeri Yokiwa. This can be seen from the results of the calculation of the correlation value of the variable X (Phet simulation media) to the variables Y1 (critical thinking) and Y2 (student learning outcomes). The results of the correlation analysis show that students in class XII SMA Negeri Yokiwa can think critically through learning assisted by Phet simulation media, in addition to critical thinking students succeed in getting higher learning outcomes than before using Phet simulation media. Based on observations, students seem more focused in learning when using Phet simulation media because they tend to be more interested in related experiments in Phet simulation media. Then the students linked the teacher's explanation with the investigation on the Phet simulation media. With Phet simulation media, students can calculate the amount

of voltage, current, and resistance related to solving problems on Ohm's law and resistance circuits.

The results of data processing show that there is a significant effect between Phet (X) simulation media on critical thinking skills (Y1) and student learning outcomes (Y2) in class XII of Yokiwa State High School.

From the results of linearity test data processing, it is known that the data has a linear pattern between learning using Phet (X) simulation media on critical thinking skills (Y1) and student learning outcomes (Y2) in class XII SMA Negeri Yokiwa. The deviation from the linearty sign indicates this. > 0.005 , there is a significant linear relationship between the independent and dependent variables.

Conclusion

Based on the results of the research conducted, the conclusion is that there is an effect of learning using Phet simulation media on the critical thinking skills of class XII students at SMA Negeri Yokiwa, there is an effect of learning using Phet simulation media on the learning outcomes of XII grade students at SMA Negeri Yokiwa, and there is an effect of learning using Phet simulation media on critical thinking skills and learning outcomes of class XII students at SMA Negeri Yokiwa.

It is hoped that further researchers will apply the Phet software-assisted learning method in different test studies. Before conducting research, you must look at the conditions and conditions of the school that will be used as a place of research to do research optimally.

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