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The Effect of PhET Simulation Learning Media to Improve Science Proses Skills

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Abstract

Students are expected to be able to fulfill physics learning objectives according to the basic abilities established by process skills training. Furthermore, this research aims to determine how PhET media influences student learning outcomes for constant acceleration and uniform acceleration concepts. Thinking when solving problems, facilitating group or individual searches, facilitating conversations between students to motivate them to acquire knowledge, and assessing the problem-solving process. Non-equivalent Control Group Research is a type that is conducted. This design is very similar to a pretest-posttest control group design, except that the experimental and control groups are not randomly selected. After analyzing the data in Excel, continue with SPSS. Based on the research results, the control group that used traditional learning materials had an average posttest score of 67. In contrast, the experimental class that used PhET learning materials to improve student learning outcomes had an average posttest score of 78.

Keywords: Influence, PhET Simulation, Uniform Acceleration, Constant Acceleration

INTRODUCTION

Science process skills training is part of the physics curriculum and is considered to help students achieve learning objectives in line with recognized foundational skills. One educational resource that integrates the capabilities of the scientific process is the PhET simulation. When applied, teachers help students learn by allowing them to participate actively in the learning process. Students can learn some or all of the concepts independently because they are not notified in advance when the material is offered.

In the Uniform Acceleration and Constant Acceleration materials, of course, there are difficulties, but the difficulties are only in the sub-material that is poorly understood by students where when determining the Uniform Acceleration and Constant Acceleration graphs. The average pre-test of students' science process skills showed that 40.5% had mastered the ability to observe indicators, 60.7% had achieved the ability to deduce, 37.7% had mastered the ability to identify and manipulate variables, and 39.40% had acquired the ability to estimate indicators. And the indication of data interpretation obtained the highest score of 75.5%. Media is one of the elements of the education system that needs to be aligned with the learning process to encourage equitable learning. The final step in choosing this medium is to incorporate it into learning activities so that students become accustomed to using it (Nurrita, 2018).

At this time, the advancement of science and technology is highly dependent on physics. Physics is structured knowledge obtained from facts, natural events, experimental results, and

intellectual processes. Advances in technology and science impact almost every aspect of human life in various ways. To become proficient in that regard, human abilities must be improved by providing facilities and quality of learning education in schools (Haryadi & Pujiastuti, 2019). In addition, it can also be an event related to other events. Therefore, several abstract ideas are equally challenging for children to understand. Teachers and educators must pay attention to the problems that arise so that the learning process can run according to the actual learning objectives (Rizaldi *et al.,* 2020). In this PhET research, the simulation has improved learning outcomes for students because it makes students not feel bored can increase student activities Because they can see, observe, do, and demonstrate things that can be useful in addition to listening to the teacher's explanations, students can be more involved in learning activities when learning physics.

METHOD

This study uses quantitative research to collect and display data in the form of numbers. Unequal control groups were used in the experiment. This design is somewhat similar to the pretest posttest control group, except that the experimental and control groups are not randomly selected.

Ongowo & Indoshi (2013) emphasized that science process skills can benefit students in coming up with ideas, taking responsibility for their education, and recognizing the value of research methodologies in the educational process. Science process skills, which include observation, grouping, interpretation, hypothesis, experiment preparation, and communication, are designed to help students better understand and master the series they are doing (Rizaldi *et al.,* 2020).

This study uses purposive sampling as the methodology. Sampling with the intention is one of the sample selection techniques that considers certain characteristics. Class XI 8 was also used as a research sample, namely 20 students in the control group and 22 in the experimental group. The course instructor's evaluation that the course has the same ability level is the basis for selecting this sample.

RESULTS AND DISCUSSION

The experimental group obtained an average score of 45 pretest learning outcomes, while the control group obtained an average score of 39. In the posttest results, the control group obtained an average score of 67, but the experimental group obtained an average score of 78.

The hypothesis must be verified to test the homogeneity test, and the normality test must be a prerequisite for the analysis. Tables 1 below show the normality and homogeneity of the pretest and posttest data of the experimental and control classes.

Table 1. Normality test results

Class	*Shapiro Wilk*		Conclusion
	Sig	*α*	
Pretest Control	0,382	0,05	Normal
Posttest Control	0,010	0,05	Normal
Pretest Experiment	0,037	0,05	Normal
Posttest Experiment	0,026	0,05	Normal

Table 1 shows that the Shapiro-Wilk normality test produces a high score. The pretest-posttest values of the experimental class were 0.037 > 0.05 and 0.025 > 0.05, while the control class values were 0.038 > 0.05 and 0.010 > 0.05, which showed that the results were normally distributed.

According to the Independent Sample Test, regular straight motion and regular straight motion learning materials in PhET classes affect student learning outcomes. This is shown by a smaller Sig of 0.01 < 0.05. The study's findings showed that using experimental classrooms to study PhET material improved student learning outcomes, resulting in an average posttest score of 78. In contrast, the score score on the posttest of the control group that used traditional learning materials was 67. Regarding learning outcomes, students in the experimental class performed better than students in the control group because the PhET simulation media made learning fun and interesting, making students more enthusiastic and active.

Based on the Shapiro-Wilk normality test, the results of the pretest of the experimental class had a control class value of 0.032 and a sig of 0.037. On the other hand, the posttest scores of the experimental and control classes were 0.026 and 0.010, respectively. The pretest-posttest values of the experiment are 0.037 > 0.05 and 0.026 > 0.05, but the control pretest-posttest values of 0.382 > 0.05 and 0.010 > 0.05 indicate that the data are normally distributed.

To test the homogeneity of the research data, the pretest value of the experimental and control classes of 0.645 showed homogeneous data because the sig value was 0.645 > 0.05. In addition, the control and experiment classes are valuable. The posttest sig was 0.620, which showed homogeneous researcher data because the sig value was 0.620 > 0.05.

A hypothesis test is carried out after the data on student learning outcomes is homogeneous and distributed regularly. The hypothesis was tested using the Independent Samples T-test, and parametric analysis was carried out using SPSS 30.0 For Windows software. Testing is conducted to determine whether the hypothesis is accepted or rejected. The following criteria are applied when assessing hypotheses to conclude: 1) If the level of two-sided significance (sig.) is less than 0.05 then Ha is accepted and H0 is rejected; 2) If the two-sided significance level (sig.) is greater than 0.05, Ha is accepted and H0 is rejected. The Independent Sample T-test is used to calculate the sig value. If 0.001 is less than 0.05, then H0 is rejected; otherwise, Ha is allowed based on the student's learning outcomes. It was found that PhET learning materials affected students' knowledge of regular straight motion and regular straight motion to improve science process skills after implementing the Ha Decision. Efforts to improve the learning objectives of students who study regular straight-motion material are influenced by using PhET learning tools. Consistent linear motion content is used to improve science process skills, including problem-solving strategies, group discussions to encourage students to learn as much as possible, process evaluation in problem-solving, and recommendations for solo or group searches. Therefore, PhET learning can actively shape students' problem-solving skills while creating information.

The Influence of PhET Simulation Learning Materials and Sukowono Business and Energy Materials The experimental class obtained a posttest score of 67.14 and a pretest score of 39.28, while the control class obtained an average pretest score of 49.33 and a posttest of 58.6, in accordance with the Learning Outcomes of State High School Students in 2021 – Academic Year 2022. The experimental class experienced a higher average increase in learning outcomes compared to the control class, as evidenced by the increase in the average learning outcomes seen in the pretest and posttest scores (Subiki *et al.,* 2022).

PhET simulation software-based instruction to improve understanding of light concepts. Based on the data, it can be said that students who use PhET simulation software in their learning find it easier to remember and explore concepts, acquire knowledge, and aspire higher. In addition, they can directly observe the variables of changes made to the concepts studied. PhET offers highly interactive simulations that encourage students to learn by doing, making learning more meaningful (Haryadi & Pujiastuti, 2019).

CONCLUSION

PhET tries to track student progress based on research findings in the learning material. In addition, the group that used learning media obtained an average score of 78. In contrast, the control group that used traditional or no learning methods obtained an average score of 67.

The average score in the experimental class was 67 when compared to the control group. Student learning outcomes have improved. As a consequence of using PhET simulation learning materials in experimental classrooms, control improves teaching and encourages increased student engagement. The students' learning outcomes on regular straight motion and straight motion materials change regularly to improve the ability of the science process to be influenced by PhET learning materials. The use of PhET learning materials influences learning outcomes. Learning regular straight motion and related topics can help students become more proficient in science.

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