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Effectiveness of Physics Edutainment Learning with PhET Media on Science Process Skills of Students

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Abstract: This study aims to determine the effectiveness of Physics Edutainment learning with PhET media on science process skills of Payakumbuh 2 Senior High School students. This type of research is a quasi experiment using Counterbalance Design. The research population is class XI MIPA with sample classes XI MIPA 5 and XI MIPA 7. The research instruments used are observation and tests. Data were analyzed using two-Sample Assuming Equal Variances. The results of the study in terms of the skills aspect show that, the average value of the results of the observation sheet of the science process skills of students is better with Physics Edutainment learning. From the aspect of knowledge, the average score of students' science process skills tests is better with Physics Edutainment learning. Mastery learning outcomes reach 90.7% and the average value of the KKM is 88.61. Then it can be concluded that the learning of Physics Edutainment is effective in improving students' science process skills in the matter of wave interference and global warming symptoms.
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Keywords: *Physics Edutainment, PhET Simulation, Science Process Skills*

INTRODUCTION

21st Century competencies students need to have in learning. For this reason, learning in educational institutions needs to practice 21st century competencies. Learning developed in the 21st century is learning that is able to develop competencies in their entirety. The 21st century competency framework requires learning that guides students to be creative, innovative, think critically in problems solving, and communicative. Facing 21st century learning, students must have a variety of skills, knowledge and digital literacy abilities, as well as mastering information and communication technology (Haryono, 2017; Hariyanto, 2016; Wijaya et al., 2016)

One of the real efforts of the Indonesian government to prepare 21st century competencies is to compile the 2013 Curriculum. The 2013 curriculum aims to prepare Indonesian people to have the ability to live as faithful, productive, creative, innovative and affective citizens and be able to contribute to the life of society, nation, state and world civilization (Permendikbud No. 70 Of 2013). It was further strengthened by Constitution Number 19 Article 19 of 2015 concerning National Education Standards.

The most fundamental change in the 2013 curriculum is science-based learning, better known as the *scientific* approach. Physics is a science subject that can develop the ability of knowledge and skills. The purpose of physics learning that is contained in the framework of the 2013 curriculum is to master the concepts, principles and have the skills to develop knowledge and an attitude of confidence as a provision to develop science

and techno logy. In physics learning, aspects of the scientific approach are integrated in the process skills approach and the scientific method that can be applied through science process skills (Abidin et al., 2018; Lindrawati & Rohandi, 2015; Kemendikbud, 2014).

Physics is generally known as subjects that are feared and disliked by students. This tendency usually starts from the learning experience, where students find the fact that physics is a heavy lesson that is not far from the problem of concepts, understanding concepts, and problems solving through a mathematical approach. The problem often faced in physics learning is the weakness of the learning process in class. Weak learning process in class causes students to become passive and have difficulty in developing their science process skills.

Science process skills is the ability of students to apply scientific methods in understanding, developing and discovering science. This skill is very necessary in physics learning, if not able to use this skill, students will have difficulty in understanding a knowledge.

The teacher is one of the key success factors in the learning process. But there are still problems in physics learning from the teacher aspect. Lutfi (in Sari, 2013) states that the problem that is seen is that the teacher's learning strategy is not appropriate, less varied, less enjoyable teaching methods, relying on worksheets sold by publishers, science is presented theoretically and has not used laboratories optimally.

This condition also occurs in Payakumbuh 2 Senior High School. The teacher has applied scientific learning. However, in its learning, it still relies on books and student worksheets from publishers, rarely presents IT-based media, the use of laboratories and KIT media has not been used optimally, only conducting experiments to prove existing theories. It was felt that it was still not effective enough to practice science process skills.

Scanleburry's opinion (in Parmin et al., 2016), There are several factors that influence students' attitude toward science, they are: teacher, learning environment, classmates, mindset, and curriculum. Widiyatmoko (2012), also argues that the difficulties of students in physics learning occur because the lesson really depends on how the teacher teaches students. The teacher should be able to change the students' fear of physics learning to be happy and awaken the activeness of students in following the lesson. The teacher needs to make sure that they teach the lesson by including the characteristics of the children, that is, wanting a pleasant condition in the classroom.

These problems must be overcome in order to improve the quality of learning. Presenting the concept of learning that not only provides creativity in learning, but also provides a touch in the classroom and emotional atmosphere of students, so students have an attraction in following the learning process.

One approach to learning that can foster joy (Joyfull Learning) and learning that is able to practice science process skills is Physics Edutainment learning. Edutainment is learning that combines educational content and entertainment activities that involve involvement, emotions and motivation (Sorathia and Servidio, 2012).

Learning in Edutainment integrates many things together, namely media, classroom environment and Play and Learn activities (Pasawano, 2015). Edutainment provides new opportunities to acquire knowledge in an interesting way, which allows trained students with a variety of different abilities to find concepts (Anikina and Yakimenko, 2015).

Physics Edutainment learning is physics learning that is entertaining and fun that involves elements of science, the process of discovery (inquiry) and an educational game. Physics Edutainment learning in it includes: (1) a fun physics learning process, (2) practicum to find the concept of subject

matter, and (3) an educational game (Widiyatmoko, 2012).

The concept of implementing Physics Edutainment learning is supported by presenting IT-based media. According to Parmin et al., (2016), good learning requires to be able to use new technology, not only to improve the ability to memorize and repeat facts, but to collect, organize and evaluate information to solve real-world problems. In this research, The researcher presents PhET Simulation media. PhET is an abbreviation of Physics Education and Technology is a site that provides physics simulations that can be downloaded for free to be used in classroom learning. PhET simulations are interactive and packaged in the form of games that make it easy for students to explore (Batuyong and Antonio, 2018).

In using PhET media students will be guided by LKPD. This learning media is in accordance with the concept of Edutainment learning which presents interesting media in the learning process, so that students' interest in participating in the learning process appears. Based on the explanation above, researchers conducted research on "The Effectiveness of Physics Edutainment Learning with PhET Simulation Media on Science Process Skills". The objectives of this study are: (1) Knowing the difference in Science Process Skills between students given Physics Edutainment Learning with PhET media assistance and students given Conventional Learning. (2) Determine the level of effectiveness of Physics Edutainment Learning with PhET media from the aspect of completeness of student learning outcomes.

METHOD

This type of research is a quasi experiment using Conterbalanced Design. The research was carried out by determining two groups of subjects. All groups are treated alternately, so that each group will get the same treatment. The research design can be seen in the following Table 1:

Table 1. Conteerbalanced Design

Group	Teatmen t	Posttest	Treatment	Posttest
`1	X	T	-	T
2	-	T	X	T

Information:

X : Physics Edutainment Learning with PhET Simulation Media.

\- : Conventional Learning (with saintific learning).

T : science process skills test

Data collection techniques through observation and learning outcomes tests. Observation of science process skills was carried out 4 times using observation sheets during the learning process. The observed aspects of science process skills are limited to the aspects of observing, predicting / grouping, hypothesizing, understanding concepts and communicating. While the learning achievement test is done 2 times. The test is done after sales of one KD. Observation data were processed using Microsoft Excel, while science process skills test data was processed with inferential statistics using the Two-Sample Assuming Equal Variances test.

RESULTS AND DISSCUSSION

Data on science process skills was obtained from observations and tests. Observation data on science process skills includes the skills of observing, predicting / grouping, hypothesizing, understanding concepts and communicating.

Results of Science Process Skills Aspect Skills

The value of each aspect observed will be averaged so that the average observations can be seen in Table 2:

Table 2. Average Science Process Skills

No	The KPS Aspect	Treatment	
		PE	Conventional
1.	Observing,	88,63	83,71
2.	Predicting / Grouping,	85,79	80,87
3.	Hypothesizing	89,01	85,03
4.	Understanding Concepts	88,63	84,84
5.	Communicating	86,92	83,52
Avarage		87,79	83,59

Data Table 2 shows, overall the average value of science process skills on the aspect of skills through learning Physics Edutainment scored 87,89, and conventional learning with a value of 83.59. Physics Edutainment learning science process skills are higher for all aspects measured.

Results of Science Process Skills Aspects of Knowledge

Science process skills from the aspects of students' knowledge are obtained from the scores of 2 tests. The results of the essay test with 10 items can be observed in Table 3:

Table 3. Posttest Results of Science Process Skills

Group	Total Posttest Score	
	Physics Edutainment	Conventional
XI MIPA 7	2770	2655
XI MIPA 5	2990	2686
Avarage	88,61	82,16

In Table 3 it can be seen that the average value of science process skills in the aspect of knowledge through Physics Edutainment learning scored 88.61, higher than conventional learning with a value of 82.16. Hypothesis testing is done using the t test. Hypothesis testing is assisted by Excel software with the provision that if the value of t value > t table then H0 is rejected and Ha is accepted. After testing the hypothesis the data is obtained as shown in Table 4 below:

Table 4. Hypothesis Test Results for Science Process Skills

t-Test: Two-Sample Assuming Equal Variances		
	Physics Edutainment	Conventional
Mean	88.61538462	82.16923077
Variance	56.11538462	39.08028846
t Stat	5.326583509	
P(T<=t) one-tail	2.17923E-07	
t Critical one-tail	1.656845226	

Based on the data in Table 4, the results of the t-Test output: Two-Sample Assuming Equal Variances obtained t value of 5.32 > t table 1.67. So according to the basis of decision making in the Two-Sample Assuming Equal Variances test, it can be concluded that Ha is accepted and H0 is rejected, meaning "Physics Edutainment Learning with PhET Simulation provides an average Science Process Skill better than conventional learning in Class XI MIPA Payakumbuh 2 Senior High Scool.

Effectiveness of Science Process Skills

The effectiveness of learning in this study refers to the effectiveness of student learning outcomes. The effectiveness of learning outcomes using the following indicators:

a. The average final test score is equal to or greater than the KKM value.
b. Classical completeness occurs above 80%

The results of the effectiveness of Physics Edutainment and conventional learning can be seen in Table 5 below:

Table 5. Average Value of Learning Outcomes

Learning Type	KPS Value	KKM	completeness
Physics Edutainment	88,61	80	90,7%
Conventional	82,16	80	79%

Based on Table 5, the average score for physics edutainment learning is 88,61 and for conventional learning is 82,16. Completeness in Physics Edutainment learning is 90,7% and conventional learning is 79%. The average value of science process skills for both classes is higher than the KKM value of 80. But Physics Edutainment learning gets higher scores than conventional learning with the percentage of completeness of science process skills that is 90,7%.

Based on the results of the data obtained, it is known that the application of Physics Edutainment learning provides science process skills that are better than conventional learning. The results of this study are relevant to research by Budi et al., (2014), which shows the application of Physics Edutainment learning is able to provide better student learning outcomes.

Assessment of aspects of skills in general shows that students who are given Physics Edutainment learning with PhET media produce better science process skills. This is because in the learning process students are actively involved, and do practicum using IT media independently.

Edutainment with PhET is able to train students' science process skills well. This PhET simulation is interactive and packaged in a form like a game that makes it easy for students to explore (Batuyong and Antonio, 2018). An independent practicum using PhET media is able to optimize the use of students' sensory functions well, starting from running their own simulations, observing various semulations, etc.

The use of PhET Simulation is guided by LKPD. Students are asked to record every data obtained, observe every comparison of concepts in the simulation, link observations and express possibilities that occur that have not been observed. This makes the training in grouping / predicting and hypothesizing students' skills trained. With this learning, students are able to understand the concept of material well, because students discover their own concepts from teaching material. Students are also trained to conclude findings and submit findings, so that students' communication skills have increased.

While for the assessment of aspects of knowledge obtained the average value of science process skills tests is better in Physics Edutainment learning with PhET media compared with conventional learning. The high average score of science process skills tests in Physics Edutainment learning is caused by students being able to explore learning directly. The level of understanding of students' concepts is more quickly achieved because they are able to find their own concepts in a series of learning. This finding is in accordance with research by Umar et al., (2016), which shows that learning Science Edutainment can improve students' understanding of concepts.

In the presence of fun learning that is collaborated with virtual media labs and games, students can take part in a series of lessons that hone their process skills well. This is relevant to research conducted by Indriati, (2012), which shows that the application of Science Edutainment can improve student learning outcomes. Tunde et al., (2016) also stated that the application of animation-based edutainment methods can improve student learning outcomes.

Physics Edutainment Learning is an entertaining and fun learning of physics by involving the elements of science, the process of discovery (inquiry) and educational games (Widiyatmoko, 2012). Physics Edutainment Learning provides effective learning in improving student learning outcomes. This is evidenced by the achievement of indicators of the effectiveness of learning outcomes, namely the average value of learning outcomes 88,21 and completeness of learning outcomes of 90,7%. The results of this study are relevant to the research of Widiyatmoko, (2010) on the Effectiveness of physics learning with the Physics Edutainment approach assisted by Interactive Media, that classical completeness of learning outcomes in classes receiving Physics Edutainment treatment increased by 20% to 80%.

The achievement of the effectiveness of physics learning outcomes with Physics Edutainment learning is caused by students being more active in a series of process skills. This is supported by Physics edutainment learning itself, where this learning changes the classroom atmosphere more pleasant, thus making students eager to start and be directly involved in the learning process.

Besides that, Physics Edutainment learning uses inquri learning model which is strengthened by presenting the PhET Simulation media, where students can play and run the media themselves in the learning process. PhET media is also able to make an abstract physics animation become visible. This is in line with the theory put forward by Hamid, (2011) that learning done by listening, seeing, discussing and doing something will make students gain knowledge and skills better.

CONCLUSION AND RECOMMENDATION

Based on the results of the study it can be concluded that Physics Edutainment learning with PhET Simulation media can develop students' science process skills. The application of Physics Edutainment learning is also able to provide effective learning from the aspect of completeness of student learning outcomes.

Physics Edutainment Learning with PhET Simulation Media can be used as an alternative for educators in their efforts to improve students' science process skills.

Researchers are still limited to the concept of wave interference material and the symptoms of global warming, so it is hoped that further research will be applied to other physics subject matter covered in PhET Simulation media.

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