JCS 1(1) (2023)

BPI Journal of Community Service

https://journals.balaipublikasi.id

Training on Using PhET Media on Wave Material for Class XI Students at Islamic Senior High School of Syaikh Abdurrahman Kotaraja, East Lombok, West Nusa Tenggara

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Received: September 22, 2023
Revised: October 5, 2023
Accepted: November 4, 2023
Published: November 30, 2023

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Abstract: This training activity aims to improve the ability of class XI students at Islamic Senior High School of Syaikh Abdurrahman Kotaraja, East Lombok in understanding the concept of waves through practical activities using the help of PhET simulations. This activity is carried out through three stages, namely preparation, implementation, evaluation. In general, this training activity was successful and right on target, because the training participants felt they had been equipped with how to carry out simple experiments using PhET media in learning physics. In addition, the training participants were quite satisfied with the training and wanted the training to be sustainable.

Keywords: Media; PhET; Waves

Introduction

Entering the 21st century, the challenges in implementing school education are increasing. There are at least three aspects that greatly affect the world of education today, namely globalization, technology and innovation, and student learning methods (Sulasmi et al., 2020). One of the 21st century skill areas is learning and innovation, which involves critical thinking (Rustama, 2020). Critical thinking skills include the ability of people to ask questions to solve problems, analyze and evaluate alternatives from different perspectives, and think critically about decisions and processes (Redhana, 2019; Sujanem et al., 2019; Zubaidah, 2016).

Based on interviews with teachers and students at Islamic Senior High School of Syaikh Abdurrahman Kotaraja, it is known that science laboratory activities are still very limited. There are several things that cause limitations in this laboratory activity, including limited laboratory space, limited laboratory equipment, damaged laboratory equipment, even laboratory space used in classrooms. Therefore, science teachers (especially physics teachers) manage their learning theoretically and mathematically, not applying a process competency approach through research activities or scientific work. Laboratory activities are places where scientific theory is applied, theory tests, certification tests, research and so on with equipment that completes adequate facilities in quantity and quality (Lutfia Ningrum, 2022; Rasyid & Nasir, 2020).

One of the efforts to eliminate the availability of laboratory equipment in the form of physical equipment and a very limited learning environment owned by schools is the use of Information and Communication Technology (Suarja et al., 2016). Finkelstein et al. (2005) says that computers can support the practical application of physics both in collecting, presenting, and processing information. In addition, a computer can also be used to edit experiments and view the complete

How to Cite:
Muliyadi, L., Doyan, A., Susilawati, S., Hamidi, H., Hakim, S., & Munandar, H. (2023). Training on Using PhET Media on Wave Material for Class XI Students at Islamic Senior High School of Syaikh Abdurrahman Kotaraja, East Lombok, West Nusa Tenggara. *BPI Journal of Community Service*, 1(1), 6–10. Retrieved from https://journals.balaipublikasi.id/index.php/jcss/article/view/67

experiment in a virtual format called the Virtual Laboratory Model (VLM). However, the development of information and communication technology is very rapid and has penetrated into various fields of human life, and has not been widely used in schools for learning. The use of information technology, especially the use of computers at various levels and types of educational institutions, seems to be uneven, with the exception of universities in general, which have access to this internet technology.

At other levels and educational channels such as high school and junior high school, where the learning process is still relatively conventional (face to face), which is actually no longer able to meet the educational needs of an increasingly complex society, it requires innovation and media that are able to overcome it. One of the media that can be used is PhET (Physics Education Technology) (Wieman et al., 2008). PhET is an educational software that contains a simulation of a symptom or physical phenomenon in accordance with the development of learning technology (Perkins et al., 2006). PhET contains interactive simulations in the form of physical phenomena based on research that can be accessed for free (Sumargo & Yuanita, 2014). PhET was developed by the University of Colorado in Boulder, America (University of Colorado at Boulder) in order to provide virtual laboratory-based physics teaching and learning simulations that make it easier for teachers and students to use them for classroom learning (Wieman et al., 2010). PhET simulations are very easy to use. This simulation was written in Java and Flash and can be run using a standard web browser as long as the Flash and Java plug-ins are installed. In other words, PhET simulations are user-friendly simulations.

Based on the problems of media facilities faced by teachers and students, one solution is to implement learning through VLM. The application of VLM in learning physics can train thinking skills, science process skills, communication skills, ICT skills, and interpretation skills. One of the VLM that is growing rapidly at this time, especially in learning physics is "PhET Simulation Interactive" which was developed by the University of Colorado in the United States. PhET can give students a lot of freedom to carry out investigative activities to identify and manipulate variables, determine response variables and control variables. During the implementation of the experiment, students can also see how the effect of the manipulated variable on the response variable so that students can test hypotheses. This is the same when students carry out experimental activities using laboratory equipment as a real laboratory.

Based on this situation analysis, it is necessary to conduct wave material training using PhET media for class XI students at Islamic Senior High School of Syaikh Abdurrahman Kotaraja, making it easier for students to understand wave material that seems abstract.

Method

Responding to the problems that result in less interactive physics learning in class, this problem can be solved by providing training to students using the PhET application as a medium in understanding wave material that seems abstract. The stages that will be passed in solving this problem are the preparation stage, the implementation stage, and the evaluation stage (Doyan et al., 2019; Susilawati et al., 2019).

At the preparatory stage, observations were made on students, to identify problems encountered in the learning process. The observation results found that learning was less interactive, the use of instructional media was still lacking, and practicums were rarely carried out due to limited practicum tools so that students were less active in the learning process. One effort to solve this problem is to conduct training on wave material using PhET media for class XI students at Islamic Senior High School of Syaikh Abdurrahman Kotaraja, making it easier for students to understand wave material that seems abstract.

The next stage is the implementation process which is a follow-up to solving the problems experienced by students in the learning process, namely by carrying out direct training on how to use PhET, so that learning becomes interactive. At this stage, students are guided to design and conduct wave material experiments. The final stage is the evaluation of the results of the training which is carried out directly by assessing the implementation of the training in order to correct deficiencies so that further training activities are more perfect.

Result and Discussion

Training activities using the PhET application for class XI at Islamic Senior High School of Syaikh Abdurrahman Kotaraja East Lombok Regency were attended by 13 students. The training lasted for two months starting from the preparation stage, implementation and finally the evaluation stage. The target of the training is class XI students at Islamic Senior High School of Syaikh Abdurrahman Kotaraja.

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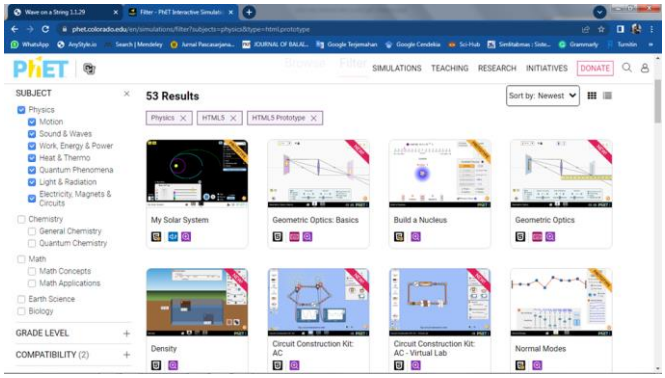


Figure 1. Initial appearance of the PhET simulation

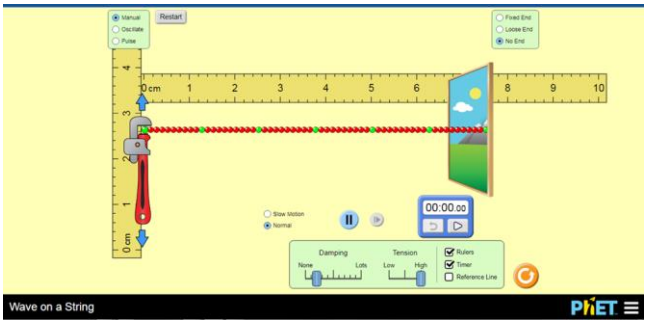


Figure 2. View of the PhET simulation of Wave material

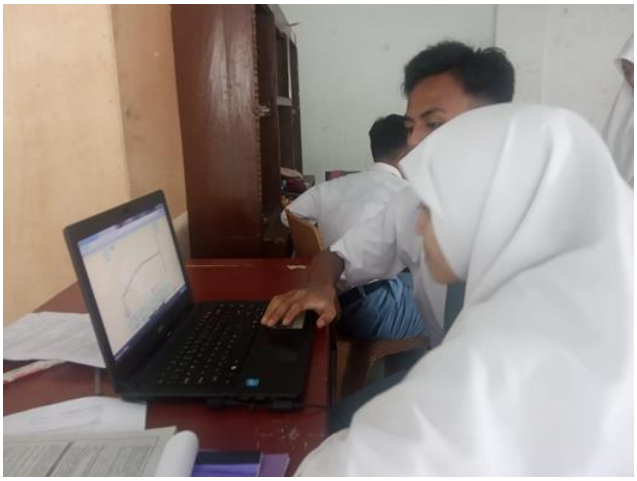


Figure 3. Practicum activities using PhET Simulation

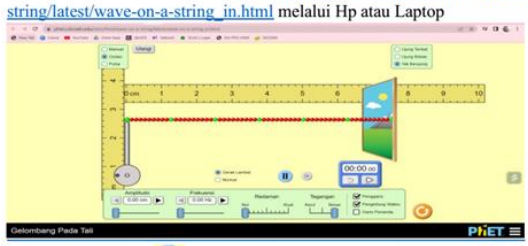
The implementation phase will be held on 7 February 2023. This simulation practicum training activity using PhET begins with providing information about what PhET is and any function. Furthermore, modules were distributed which contained guidelines and worksheets for using PhET simulations. Then carry out training activities with class XI students at Islamic Senior High School of Syaikh Abdurrahman Kotaraja.

B. Alat dan Bahan :

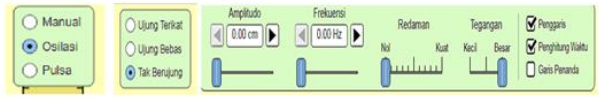
1. Virtual Lab https://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_in.html
2. Laptop/Komputer/HP

C. Langkah-Langkah Kegiatan :

1. Buka simulasi phet dengan link https://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_in.html melalui Hp atau Laptop



2. Tekan tombol pause
4. Atur besaran pada simulasi sebagai berikut



3. Aturlah amplitude redaman (damping) pada "none/nol"!
4. Aturlah amplitude dan frekuensi sesuai dengan tabel pengamatan!
5. Atur gerak gelombang "normal", lalu klik tombol "play" untuk memulai!
6. Kemudian amati gelombang yang terbentuk kemudian "pause" atur sampai titik hitam sejajar dengan putih atur dengan mengklik tanda
7. Kemudian ukur panjang gelombang dengan "ruler" dan catat hasilnya ditabel pengamatan

Figure 4. Student worksheet as a guide for training

During the learning process, there was a lot of interaction between the trainees and the resource persons as indicated by the many participants asking questions to the resource persons regarding the material presented. This shows that in these learning activities all training participants were very enthusiastic and active in participating in learning. At the end of the meeting, a questionnaire was given to the participants' responses to the training. The results of the responses of the training participants can be shown in Table 1.

Table 1. The Results of the Training Participants' Responses

Student's Name	Participant Response
A	Very interesting activity
B	Interactive and interesting. Hopefully in the future training like this related to physics.
C	Interactive and interesting. A lot of knowledge was obtained, in the future hopefully it can be held again.
D	My impression of participating in this activity was that it was very interesting, and added to my insight and reference later to understand physics concepts, especially the matter of waves.
E	Interesting and fun, thank you for the presenter.
F	Make more understand about the material waves in Physics subjects.
G	It is very useful for developing our creativity as students, practicum activities without

Student's Name	Participant Response
	having to buy expensive tools, but simply using the PhET application.
I	Thank you very much to the presenters regarding the material that has been presented, this is very good and interesting. Thank you for providing very useful material.
J	Very useful, very inspiring to develop learning media in future research.
K	Very useful and inspiring in science and physics learning to develop practicum tools that can be used in schools.
L	Very motivating. Light language, and easy to understand. Thank You.
M	Can motivate and provide innovation regarding the manufacture of learning media.

Based on table 1 it can be seen that overall the activities were carried out well. In addition, the training participants, in this case students of class XI at Islamic Senior High School of Syaikh Abdurrahman Kotaraja, were happy to have gained invaluable experience with this activity. The experience in question is: students can design and carry out their own practicum using Phet media without having to find and buy expensive tools. In addition, the training participants were quite satisfied with the training and wanted the training to be sustainable.

Conclusion

This Wave material training activity using PhET media is very useful for class XI students at Islamic Senior High School of Syaikh Abdurrahman Kotaraja because it can add insight on how to carry out experiments without having to provide more expensive practicum tools so that it can increase student activity during learning. In general, this training activity was successful and right on target, because the training participants felt they had been equipped with how to carry out simple experiments using PhET media in learning physics. In addition, the training participants were quite satisfied with the training and wanted the training to be sustainable.

Acknowledgements

Acknowledgments The authors thank the Head of the Islamic Senior High School of Syaikh Abdurrahman Kotaraja and all parties who have supported this training activity to completion.

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