

PhET Virtual Simulation Training to Improve the Competence of Elementary and Secondary School Teachers in Taniwel

Ashari B.P. Dulhasyim¹, Fryan Sopacua¹, Sally Untajana¹, Venty Sopacua^{1*}

¹Physics Education, Universitas Pattimura, Ambon, Indonesia.

Received: February 9, 2026

Revised: February 28, 2026

Accepted: March 30, 2026

Published: March 31, 2026

Corresponding Author:

Venty Sopacua

givensohilait@gmail.com

DOI: [10.29303/ujcs.v7i1.1584](https://doi.org/10.29303/ujcs.v7i1.1584)

© 2026 The Authors. This open access article is distributed under a (CC-BY License)



Abstract: This community service activity aims to equip teachers at SD Kristen Nikulukan Niwelehu, SD Negeri Sehati, and SMP Negeri 8 Taniwel to be able to implement PhET Simulation as an experimental-based learning media that is innovative and meets the needs of students. This program is designed to assist teachers in supporting learning related to experimental or practical activities for schools that do not have a Laboratory. In addition, it is important for a teacher to master and integrate technology-based learning media such as PhET simulations in the Science learning process. This mastery not only helps teachers deliver material in a more interesting and interactive way, but also encourages students to actively explore scientific concepts independently, making learning feel more engaging and meaningful. The service team organizes activities based on 4 stages, namely the preparation and briefing stage, implementation, and program sustainability. Community service activities received a positive response from partner parties, as evidenced by the responses from teachers, with teachers being very enthusiastic about participating in this activity (89%), and the presentation of the material and its application being felt very interesting to follow (86%), so that community service activities at SD Kristen Nikulukan Niwelehu, SD Negeri Sehati, and SMP Negeri 8 Taniwel can improve teacher competence in partner schools.

Keywords: PhET App, Science Education, Educational Media.

Introduction

Science education at the Primary and Secondary levels faces a real gap in access to practical experiments, where many schools lack adequate laboratory facilities, making experimental experiences limited, while globally the education community is moving towards digital practicum (Laksono et al., 2023; Muslim et al., 2022). In Indonesia, quantitative research shows an increase in the use of virtual laboratories as an effective alternative to practicums to overcome infrastructure, time, and safety constraints, while maintaining the quality of students' cognitive achievements and science processes at various levels (Yusuf et al., 2024). In the context of learning ecosystem transition, simulation-based practices such as PhET are considered to expand access to safe, fast, and measurable experiments, as well as being relevant for schools with limited physical laboratory resources (Atmojo et al., 2024). This issue

urgently needs to be addressed at the level of local public schools because it has direct implications on the equal quality of science education services and the readiness of students to face practice-based assessments in the current curriculum (Abdjul et al., 2019).

Entering the digital era of the 21st century, students are required to master various essential skills such as critical thinking, creativity, collaboration, as well as effective communication abilities. In science subjects, students are required to be able to relate relevant concepts and develop based on the results of experiments and observations (Carin, 1993). Based on this opinion, science should be taught by involving experimental and observational activities, not merely the transfer of knowledge. Through experimental and observational activities, learners can directly interact with facts, objects, as well as scientific phenomena and occurrences in order to build meaningful knowledge. In the field of science, there is technology available that can

How to Cite:

Dulhasyim, A. B., Sopacua, F., Untajana, S., & Sopacua, V. (2026). PhET Virtual Simulation Training to Improve the Competence of Elementary and Secondary School Teachers in Taniwel. *Unram Journal of Community Service*, 7(1), 103–107. <https://doi.org/10.29303/ujcs.v7i1.1584>

support practical activities which unconsciously can help teachers and students in providing an effective learning experience (Tibrani et al., 2022), helping to explain and understand, facilitating and easing learning activities. The learning support technology is PhET Simulations.

PhET simulation is an application that simulates learning in a visual form that is useful for mathematics and science learning, developed by the University of Colorado USA (Riantoni et al., 2019; Serevina et al., 2021). PhET simulation allows students to learn independently and actively, making learning more interactive because students can connect real natural phenomena with the underlying science (Mufliah et al., 2023). PhET simulations also make the material being studied more interesting and appear "real." Thus, students can become more interested in learning this material, which will ultimately make it easier for them to understand the material (Sylviani et al., 2020).

The main purposes of PhET simulations are: (1) PhET simulations increase student engagement and enhance learning; (2) PhET simulations are specifically designed to support students in building a strong conceptual understanding of physics through exploration (Perkins et al., 2006). In addition, the use of PhET simulations in learning aligns with the paradigm of active and constructivist learning (Cindy et al., 2025). Previous findings indicate that PhET is more effective compared to conventional methods, as it allows learners to conduct virtual experiments in an interactive manner, enabling them to grasp concepts more deeply (Darmaji et al., 2023).

However, in reality, many teachers still rely on conventional lecture methods in teaching, which results in low student engagement and a lack of understanding of the material. Although some schools have been equipped with technological facilities, their utilization is often not optimal because teachers have not received adequate training related to the use of virtual laboratories (Darmaji et al., 2023). Another obstacle is the limitation of computer devices and uneven internet access. Although PhET Simulation can be used offline, many teachers still feel unfamiliar or lack confidence in integrating this software into learning (Bahtiar et al., 2020).

Kristen Nikulukan Niwelehu Elementary School, Sehati Public Elementary School, and Taniwel Public Junior High School do not have a laboratory; teachers mainly use conventional concept mastery activities. In addition, internet access is inadequate. Therefore, the PhET application is felt to be able to help elementary and secondary school teachers in Taniwel, so a training program for teachers is needed to improve their ability to utilize learning technology effectively and optimally.

The purpose of this training is to equip teachers at SD Kristen Nikulukan Niwelehu, SD Negeri Sehati, and SMP Negeri 8 Taniwel to be able to implement PhET Simulation as an innovative experiment-based learning media that meets the needs of students. This program is designed to help teachers support learning related to experimental or practical activities for schools that do not have a laboratory.

Method

To address the problems that have been previously mentioned in the Introduction, it is necessary to hold a Community Service Program (PPM) by lecturers in the Physics Education Study Program. The steps that will be carried out are as follows:

1. Preparation and Briefing

At this stage, a discussion is conducted by the community service team about the material to be trained for educators and the implementation mechanism of the PPM activities, as well as the distribution of material to be presented by the team. The material prepared by the PPM team is about the PhET Application and its Implementation. The selection of this material is based on the needs of educators at SD Kristen Nikulukan Niwelehu, SD Negeri Sehati, and SMP Negeri 8 Taniwel.

2. Implementation

The implementation of community service activities is carried out based on the results of situation analysis, problems found in partners, and solutions that have been agreed upon by the PPM implementation team with the partners. The stages of implementing this service can be detailed as follows;

a. Socialization

- Starting with conveying the goals of PPM and the benefits of the activities to teachers at SD Kristen Nikulukan Niwelehu, SD Negeri Sehati, and SMP Negeri 8 Taniwel.
- Providing material related to the PhET Application and its implementation.

b. Training

- Giving teachers the opportunity to use PhET simulations.
- Assist teachers in implementing PhET simulations.

c. The application of technology

The team strives to develop teachers who are skilled/proficient in the use of technology, so that in addition to its application in delivering material, the team also attempts in small groups to further stimulate related to PhET simulations.

d. Evaluation

Provide a teacher response instrument related to the training given so that the team can understand

the teachers' responses to the training and use it as evaluation material for the next PPM.

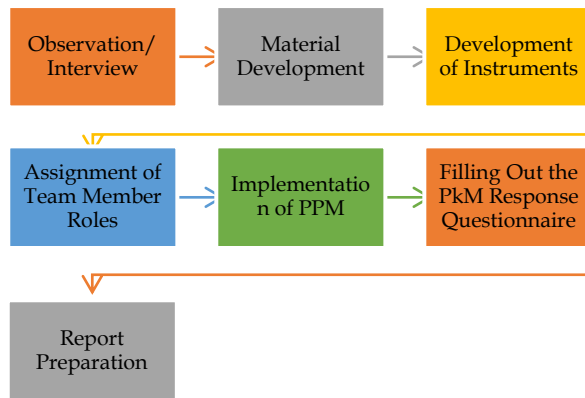


Figure 1. Stages of Community Service Activities

3. Program Sustainability

The evaluation of the implementation of the PPM program that has been carried out during the PPM implementation stage serves as a basis for preparing the sustainability of the program. The sustainability of this PPM program includes, among others;

- Creating a plan for follow-up activities or follow-up that can deepen teachers' understanding/skills about PhET applications.
- Providing additional resources or support for schools, especially teachers, to further hone skills/knowledge in using the PhET application.
- Considering collaboration between FKIP and schools to hold similar activities regularly.

Result and Discussion

The implementation of PPM activities in November began with the interview process with one of the teachers at SMP Negeri 8 Taniwel. Based on the interview results, it was found that the partner school has no laboratory and has weak internet access. Based on this issue, the team began to discuss, and the result of the team's discussion was the implementation of community service with one of the topics being the PhET virtual simulation. Then the team started to prepare a proposal, instruments, and an implementation permit to be submitted to the Principal of SD Kristen Nikulukan Niwelehu, SD Negeri Sehati, and SMP Negeri 8 Taniwel. After that, the activities were scheduled by the Principal of SMP Negeri 8 Taniwel and the Principal of SD Negeri Sehati on Monday, November 17, 2025, at 09.00 WIT until finished, taking place at SMP Negeri 8 Taniwel.

The activity began with a welcome speech from the Principal of SMP Negeri 8 Taniwel, who in his speech expressed gratitude for the visit of the community service team to their school due to its location being very

far from Pattimura University. In addition, in the speech, they also expressed thanks for choosing a topic that matches their problems and needs because in these schools the internet connection is very poor and there is no laboratory. After the welcome, the next is the presentation of material related to the PhET Application and its implementation. Documentation of the presenter's activities is shown in Figure 2 below.



Figure 2. Presentation of Material and Its Application (Experiment)

The outline of the material provided is (1) Introduction to the PhET Application, including what features and specifications the PhET application has and which subjects can use this application. (2) How to use the PhET application offline because partner schools have unstable internet access. (3) Experimenting with the use of the PhET application for teachers. After the material was delivered, the team distributed a questionnaire on teachers' responses to the Community Service Program (PPM) activities. The results of the response questionnaire are presented in Figures 3 (a) and (b) below.

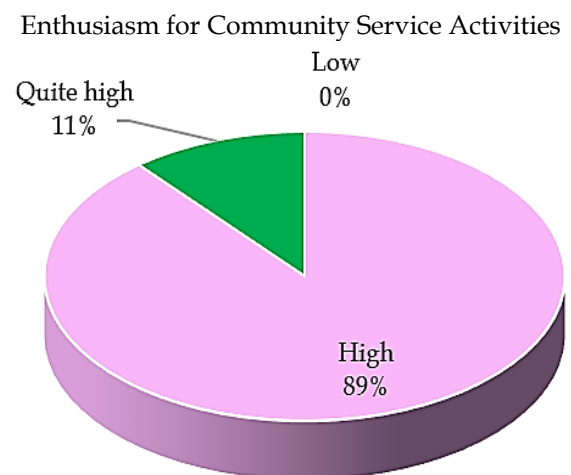


Figure 3. (a) Enthusiasm for Community Service Activities

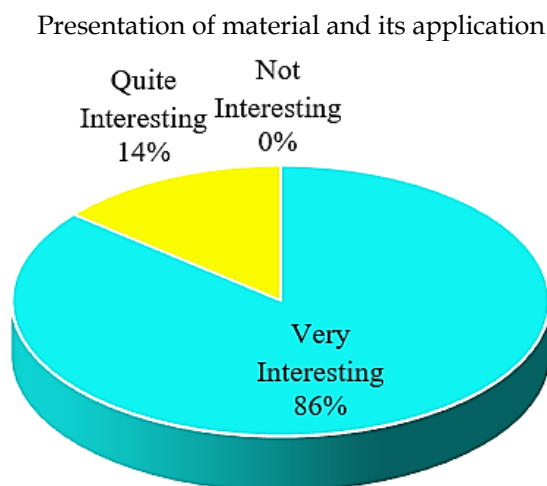


Figure 4. (b) Presentation of the Material

Based on the results of the questionnaire presented in Figure 3.2, it was found that the community service programs at SD Kristen Nikulukan Niwelehu, SD Negeri Sehati, and SMP Negeri 8 Taniwel received positive responses. In the first questionnaire regarding the enthusiasm of teachers related to PPM activities, it was found that 89% of teachers were very enthusiastic about participating in these PPM activities because these activities were very suitable for the needs of the teachers, especially science teachers. This has a positive impact on the questionnaire regarding the delivery of the applied material, with 86% of teachers finding it interesting, so the teachers seriously follow the delivery of material about the PhET application and participate in experiments using the PhET application offline. Interactive simulations can provide dynamic access to various levels of representation, making objects that cannot be directly observed by the eye visible (Watson et al., 2020).

This PhET application not only helps teachers in the learning process, but it is also interesting to use and can develop 21st-century skills. Teachers are trained to design virtual experiments, analyze data, and draw conclusions based on simulation results (Sujanem et al., 2019). This ability is very important in teaching Science, where students are often faced with complex problems that require critical and analytical thinking (Bhakti et al., 2019). Research by Muzana et al (2021) shows that PhET simulations are effective in improving the Science learning process in the classroom. This media allows students to learn without a real laboratory, while also improving their digital literacy and learning outcomes. Based on this statement, it is important for a teacher to master and integrate technology-based learning media such as PhET simulations in the Science learning process. Mastery of this not only helps teachers deliver material in a more engaging and interactive way, but

also encourages students to actively explore Science concepts independently.

This activity ran smoothly according to the schedule, starting from the opening ceremony which was directly opened by the Principal of SMP Negeri 8 Taniwel, followed by Ice Breaking (Cooling Down) by the volunteer team present at the time to maximize the focus of the teachers. Next, the main training activity involving lecturers and students.

Conclusion

Community service activities received a positive response from partner parties, as evidenced by the responses from teachers, with teachers being very enthusiastic about participating in this activity (89%), and the presentation of the material and its application being felt very interesting to follow (86%), so that community service activities at SD Kristen Nikulukan Niwelehu, SD Negeri Sehati, and SMP Negeri 8 Taniwel can improve teacher competence in partner schools. From this activity, the teachers are also already able to use the PhET application and it will be applied later in the learning process. The suggestion that the team can give is that PhET application training should be conducted again because the team feels it is necessary and very much needed in the school due to the absence of a Laboratory.

Acknowledgments

The team thanks the Principal of Nikulukan Niwelehu Christian Elementary School, the Principal of Sehati Public Elementary School, and the Principal of Taniwel Junior High School 8, along with the teachers who gave the team the opportunity to carry out community service. The team also thanks various parties who have assisted up to this point.

References

- Abdjul, T., Ntobuo, N. E., & Payu, C. (2019). Development Of Virtual Laboratory-Based Of Learning To Improve Physics Learning Outcomes Of High School Students. *Jurnal Pendidikan Fisika Indonesia*, 15(2), 97-106. <https://doi.org/10.15294/Jpfi.V15i2.12367>
- Atmojo, S. E., Wardana, A. K., & Muhtarom, T. (2024). The Effectiveness Of An Internet Of Things (Iot)-Based Virtual Science Laboratory On Nervous System Material In Science Course. *Jurnal Paedagogy*, 11(1), 71. <https://doi.org/10.33394/Jp.V11i1.7938>
- Bahtiar, B., Ibrahim, I., & Maimun, M. (2024). The Effect Of Phet Simulation-Based Learning On The Ability To Understand Elementary Science Concepts In Work And Energy Material. *Jurnal*

- Pendidikan Ilmu Pengetahuan Alam (Jp-Ipa), 5(1), 28-35. <https://doi.org/10.56842/jp-IPA.V5i1.286>
- Bhakti, Y. B., Astuti, I. A. D., & Dasmo, D. (2019). Peningkatan Kompetensi Guru Melalui Pelatihan Phet Simulation Bagi Guru Mgmp Fisika Kabupaten Serang. *J-Abdipamas (Jurnal Pengabdian Kepada Masyarakat)*, 3(2), 55-62. <https://doi.org/10.30734/J-Abdipamas.V3i2.574>
- Carin, A. A. (1993). *Teaching Science Through Discovery*. Merrill. <https://books.google.co.id/books?id=JbEaaaaaaaj>
- Cindy, R. D. H., Mufidah, W., & Erlina, N. H. (2025). Pengaruh Penggunaan Simulasi Digital Dalam Pembelajaran Konsep Gaya Dan Gerak. 06(02).
- Darmaji, D., Purwaningsih, S., Lestari, N., Riantoni, C., & Falah, H. S. (2023). Pelatihan Phet Virtual Laboratory Untuk Meningkatkan Kompetensi Guru Ipa Dalam Merancang Kegiatan Pembelajaran. *Selaparang: Jurnal Pengabdian Masyarakat Berkemajuan*, 7(2), 739. <https://doi.org/10.31764/jpmb.V7i2.14252>
- Laksono, P., Wicaksono, A., & Habisukan, U. H. (2023). Pendampingan pemanfaatan simulasi PhET sebagai media interaktif virtual laboratorium di MTs Tarbiyatussibyan. *Jurnal Anugerah*, 4(2), 179-192. <https://doi.org/10.31629/anugerah.v4i2.4843>
- Muflihah, N., Afiatna, F. A. N. F., & Sumarsono. (2023). Analisis hasil belajar praktikum fisika dasar menggunakan media pembelajaran phet simulasi. *Jurnal Pengabdian Kepada Masyarakat Nusantara*, 7(1), 143-147.
- Muslim, Abd. Q., Hermawan, H., Cahyasari, E., & Fanani, M. A. (2022). Virtual Laboratory: An Alternative Method Of Practicum Learning In Higher Education During The Covid-19 Pandemic. *Journal Of Education Technology*, 6(2), 226-236. <https://doi.org/10.23887/jet.V6i2.41629>
- Muzana, S. R., & Lubis, S. P. W. (2021). Penggunaan Simulasi Phet Terhadap Efektifitas Belajar Ipa. 5(1).
- Perkins, K., Adams, W., Dubson, M., Finkelstein, N., Reid, S., Wieman, C., & Lemaster, R. (2006). Phet: Interactive Simulations For Teaching And Learning Physics. *The Physics Teacher*, 44(1), 18-23. <https://doi.org/10.1119/1.2150754>
- Riantoni, C., Astalini, A., & Darmaji, D. (2019). Studi Penggunaan Phet Interactive Simulations Dalam Pembelajaran Fisika. *Jurnal Riset Dan Kajian Pendidikan Fisika*, 6(2), 71. <https://doi.org/10.12928/Jrkipf.V6i2.14202>
- Serevina, V., Yumna, A., & Islamiah, N. (2021). Pelatihan Media Phet Simulation Untuk Pembelajaran Jarak Jauh. 1.
- Sujanem, R., Sutarno, E., & Aris Gunadi, I. G. (2019). Pelatihan Dan Pendampingan Pembuatan Media Simulasi Praktikum Ipa Smp Dengan Program Simulasi Phet. *International Journal Of Community Service Learning*, 3(1), 11. <https://doi.org/10.23887/ijcs.V3i1.17485>
- Sylviani, S., Permana, F. C., & Utomo, R. G. (2020). Phet Simulation Sebagai Alat Bantu Siswa Sekolah Dasar Dalam Proses Belajar Mengajar Mata Pelajaran Matematika. *Edsence: Jurnal Pendidikan Multimedia*, 2(1), 1-10. <https://doi.org/10.17509/Edsence.V2i1.25184>
- Tibrani, M., Riyanto, R., & Anggraini, N. (2022). Pendampingan Simulasi Pemodelan Sains Menggunakan Software Phet Simulations Sebagai Media Pembelajaran Digital Berbasis Virtual Laboratory Bagi Guru Ipa Palembang. *Dharma Raflesia: Jurnal Ilmiah Pengembangan Dan Penerapan Ipteks*, 20(1), 169-178. <https://doi.org/10.33369/Dr.V20i1.21183>
- Watson, S.W., Dubrovskiy, A.V., & Peters, M.L. (2020). Increasing chemistry students' knowledge, confidence, and conceptual understanding of pH using a collaborative computer pH simulation. *Chemistry Education Research and Practice*, 21(2), 528-535. <https://doi.org/10.1039/C9RP00235A>
- Yusuf, M., Yunginger, R., & Nainggolan, R. (2024). Quality Of Physics Teaching Module Based On Problem-Based Learning Model Integrated With Phet Simulation On Energy And Its Transformation. *Jurnal Penelitian Pendidikan Ipa*, 10(6), 3007-3016. <https://doi.org/10.29303/Jppipa.V10i6.7037>