OPEN ACCESS

Jurnal Riset Pendidikan MIPA, 10(1): 9-16, June 2026
ISSN 2549-0192 (e) | 2549-0184 (p)
http://new.jurnal.untad.ac.id/index.php/jrpm/

Effectiveness And Understanding Of Student Concepts In Online Practicumu Sung Phet Simulation During The Covid-19 Pandemic

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Article History
Received 02 February 2026
Revised 12 March 2026
Accepted 05 May 2026

Keywords:
Effectiveness, Mastery of Concepts, PhET

Abstract

This study aims to determine the effectiveness of online practicum with PhET simulation in practicum activities and describe the process of mastering student concepts through online practicum with PhET simulation. The method used in this research is qualitative research with a description approach or better known as descriptive qualitative. Where qualitative descriptive methods are part of qualitative research. The respondents were 22 students. Data collection techniques through question tests, questionnaires and interviews. The results of the study from 22 respondents based on effectiveness indicators were the quality of learning (73%), the right level of learning (56%), intensive (62%) and time (63%). The results based on indicators of understanding concepts are extrapolation (52.14%), translation (99.18%) and interpretation (72.73%).

doi: 10.22487/j25490192.2026.v10.i1.pp.9-16

Introduction

The COVID-19 pandemic has an impact that affects various fields such as the economy, education, socio-culture and so on. Education is one of the fields that has undergone many changes due to the COVID-19 pandemic, especially education indonesia (Sudarsana et al, 2020). There is a government policy to carry out social distancing or social distancing that requires everyone to maintain distance when interacting with others to break the chain of transmission of COVID-19 (Karimi & Efendi, 2020). The implementation of social distancing has resulted in education managers issuing decisions to eliminate activities at school or campus and carry out distance learning from home, namaly by e-learning (Masrull et al., 2020).

The implementation of social distancing has resulted in education managers issuing decisions to eliminate activities at school or campus and carry out distance learning from home, namaly by e-learning (Masrull et al, 2020 ; Syaiful et al. 2021 ; Setyorini, 2020 ; Andayani et al., 2020 ; Budiman, 2021) Regarding the policies set so that educational institutions and the government must prepare alternative education for students and innovate and adapt to the use of technology. One of them is e-learning. E-learning is learning that uses the help of electronic devices with network intermediaries in the form of the internet and intranet (Simanihuruk et al. 2019). The real use of e-learning is as an "enabler" or tool to enable an effective and efficient and enjoyable learning process (Chaeruman, 2018).

Before the COVID-19 pandemic, the Physics Education Study Program carried out practicum in the laboratory starting from semester 1, namely the basic physics practicum. The other practicums include mechanics practicum, thermodynamics, school physics, modern physics, basic electronics, magnetic electricity, and waves and optics. For each practicum, it is worth 1 credit. In practicum activities, students are expected to be equipped with psychomotor mastery supported by affective and cognitive. The implementation of the practicum will be evaluated starting from the response (evaluation of students' understanding of what will be done in the laboratory, both in the form of theory and practicum work procedures), activity evaluation (activeness), reports and final exams. After the COVID-19 pandemic, the Physics Education Study Program of FKIP Untad carried out an online practicum using a PhET simulation.

The use of virtual laboratories can increase students' understanding of concepts and creative thinking abilities in physics materials (Hermansyah et al., 2015), in addition to that student learning outcomes using PhET simulations have increased higher, this is because students who learn with PhET simulations can more easily understand the material they are studying (Marlinda et al., 2016 ; Ernawati et al., 2022 ; Lepu et al., 2024).

The development of information and communication technology is a huge potential to improve the quality of education. Practicum that is difficult to do in a real laboratory, which is generally caused by the lack of practical equipment, can be done using virtual laboratory media. Virtual media is an intractive multimedia object consisting of various formats including text, hypertext, sound,

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images, animation, video, and graphics (Gunawan et al., 2013). One of the virtual laboratory applications is physics education technology (PhET) simulation. PhET (2014) explains that PhET is a site that provides learning simulations of physics, biology, chemistry and mathematics, which are provided free of charge by the University of Colorado for the benefit of classroom learning or can be used for individual learning purposes. Simulations are designed interactively, so that their use can carry out hands-on learning.

Simulation makes complex work environments can be arranged to resemble the real world (Azhar, 2017). Unlike the simulation format in general, the PhET virtual laboratory is more shown in experimental activities, such as practicum activities in the science, biology, physics and chemistry laboratories. PhET simulations provide a series of equipment and materials, so that users can conduct experiments or experiments according to the instructions and then develop other experiments based on those clues. It is hoped that in the end users can explain a certain concept or phenomenon based on the experiments they conduct virtually (Ekawati et al., 2015). The static dimension of science describes science as a product of a system of ideas (science content), which is essentially the product of research and study activities in science (Farmer and Farrell, 1980). This dimension will be researched in the effectiveness and understanding of the concept as a product. The effectiveness and understanding of concepts are expected to provide information on the extent of effectiveness and understanding of student concepts by applying PhET.

Materials and Method

The method used in this study is qualitative research with a description approach or better know as descriptive qualitative. Where qualitative descriptive methods are part of qualitative research

The subject of this study was a student of the Physics Education Study Program at Tadulako University who conducted a practicum using PhET Simulation(https://phet.colorado.edu/in/simulations/circuit construction-kit-ac-virtual-lab). The subjects were taken using purposive sampling techniques. The subjects in this study were 22 people who were taken to be selected and made research respondents, this selection based on first providing a concept mastery test of 3 numbers in the form of an essay test taken from capacitive reactance material which will be assessed based on indicators. The indicators used are using the three aspects of conceptualization, namely translation, interpretation, and exploitation (Abriani, 2016 ; Rosyidah et al., 2020). Second, providing effectiveness questionnaires to students as many as 21 statements with assessments ranging from 1-5 based on effectiveness indicators, namely, the quality of learning, the right, intensive level of learning, and time (Mutaqin et al., 2021). The three interviewing subjects on the category is excellent, good, and sufficient.

Results and Discussion

Based on the results of measuring the effectiveness of online practicum with PhET simulations which refer to several indicators of learning quality, appropriate, intensive, and time learning levels. The determination of the effectiveness value is based on the percentage of effectiveness analyzed through the questionnaire data provided. Then the subjects of the study were categorized by referring to the percent effectiveness of online practicum with PhET simulations. The effectiveness score obtained from each respondent can be seen in table 1 below.

Table 1. Each Respondent's Effectiveness Score

Respondent	Score (%)	Categories
R1	64	Good
R2	58	Enough
R3	65	Good
R4	57	Enough
R5	70	Good
R6	68	Good
R7	63	Good
R8	66	Good
R9	65	Good
R10	59	Enough
R11	61	Good
R12	69	Good
R13	70	Good
R14	61	Good
R15	81	Excellent
R16	64	Good
R17	64	Good
R18	57	Enough
R19	66	Good
R20	68	Good
R21	71	Good
R22	64	Good

The results in table 1 above, it can be seen that there is only 1 student who obtained the excellent category, 17 students who obtained the good category and 4 students who obtained the sufficient category. For the average value of the percentage based on the effectiveness indicator can be seen in Table 2.

Table 2. Average Value Results Based on Effectiveness Indicators

No	Evectivity Indicator	Average Percentage (%)	Category
1	Quality of Learning	73	Good
2	The Right Level of Learning	56	Enough
3	Intensive	62	Good
4	Time	63	Good
	Persentase	64	Good

From the results obtained based on scores and categories, 2 respondents will be selected who represent each category, namely excellent categories, good categories and sufficient categories will be interviewed. However, in the excellent category, only 1 respondent was selected because the respondents who had excellent scores only consisted of 1 student. The following information on the five respondents for the next will be interviewed in Table 3.

Table 3. Research respondents involved in interviews

Respondent code	Respondent	Category
R-15	Respondent 15	Very high
R-1	Respondent 1	High
R-3	Respondent 3	High
R-2	Respondent 2	Noun
R-4	Respondent 4	Noun

Based on Table 3 that respondent 15 is in the excellent category, respondents 1 and 3 are in the good category, and respondents 2 and 4 are in the sufficient category. To see the score of the results of understanding the concept of each respondent can be seen in table 4.

Table 4. Results of Understanding the Concept of Each Respondent

Respondent	score (%)	Categories
R1	75	Good
R2	58	Enough
R3	75	Good
R4	58	Enough
R5	75	Good
R6	75	Good
R7	75	Good
R8	75	Good
R9	75	Good
R10	75	Good
R11	75	Good
R12	58	Enough
R13	75	Good
R14	58	Enough
R15	100	Excellent
R16	58	Enough
R17	75	Good
R18	75	Good
R19	75	Good
R20	75	Good
R21	75	Good
R22	75	Good

From the results of the concept understanding test above, it can be seen that there was 1 respondent who scored with an excellent category, 17 respondents obtained a score with a good category and 4 respondents obtained a score with a sufficient category. The score has similarities with the results of the effectiveness value where 1 respondent obtained an excellent category score, 17 respondents obtained a score with a good category and 4 respondents obtained a score with a sufficient category. For the average value of the results of understanding concepts based on indicators can be seen in Table 5.

Table 5. Results of Understanding Concepts Based on Indicators

No	indicatore	Score	Category
1	Ekstrapolasi	51.14	Enough
2	Translasi	99.18	Excellent
3	Interpretasi	72.73	Good

Table 5 is the result of understanding the concept in terms of three indicators. Each of the indicators of understanding the concept has the same ideal score, which is 4. The average score of students on the extrapolation indicator is 51.14, which means that some students have used their extrapolation ability enough, the average student score on the translation indicator is 99.18, which means that students are very good at using their translation ability, and the average score of students on the interpretation indicator is 72.73, which means that some students are already good at using their inter-achievement abilities.

Based on the results of the data analysis carried out, researchers analyzed the ability to understand concepts in student capacitive reactance material based on indicators, namely translation,

interpolation and extrapolation. The highest understanding of students' mathematical concepts is in translational indicators while, the lowest indicators of student concept understanding are in extrapolation indicators. This is because the translation indicator is the lowest level of understanding of mathematical concepts according to (Sudjana, 2010), starting from translation in the true sense, which is related to the ability of students to translate mathematical sentences into a form that is more in line with their circumstances. For example, students are asked to presuppose that if the student is currently a teacher, how the student gives an example of negative numbers that are often encountered in students' daily lives (in addition to presupposing negative numbers are "debts/ borrowing"). This is in accordance with the results of research that many students do not understand the meaning of integers and the origin of integers (Titikusumawati, 2013 ; Heswari & Gusnidar, 2024).

The laboratory practice guide is a very important component in helping students carry out the stages of practical activities independently. Laboratory practice guidelines are a learning tool so that the learning process runs easily, effectively and directed according to the objectives of the practicum (Asmaningrum et al., 2018). Good laboratory practice guidelines must be easy to understand, can be reflected by educators and students so that they can be implemented and carried out easily Pedha (2017) and Emda (2017) In addition, a good laboratory practice guide will help and provide direction to students to find, read, explore and obtain knowledge and material topics that are practiced independently so that they are skilled in the implementation of laboratory practice.

Conclusion

The effectiveness test and understanding of student concepts in online practicum using PhET simulations during the Covid-19 pandemic, it can be concluded that the average percentage of all activity indicators is in the good category. Thus, it can be concluded that online practicum using PhET simulations during the Covid-19 pandemic is effectively used in online practicum on capacitive reactance materials. This is because this simulation is able to help students in studying or finding information related to a physical phenomenon or event through interesting illustrations as they conduct experiments directly. The average score of students on the extrapolation indicator is 51.14 which means that some students have sufficiently used their extrapolation ability, the average score of students on the translation indicator is 99.18 which means that students are very good at using their translation ability, and the average score of students on interpretation indicators is 72.73 which means that some students are already good at using their inter-achievement abilities. The understanding of physics concepts that students master most is the understanding of translational and interplay concepts.

Acknowledgements

The authors expressed his gratitude and profound appreciation to all those who were sincerely helped and supported during conducting and finishing this research.

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