Students' Science Process Skills in Virtual Practicum in Science Learning

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Abstract. Online learning system causes students and lecturers to be capable of implementing long distance learning. By the presence of this system then there must be an alternative of science practicum through online in the laboratory. However, it does not guarantee the students to be capable of obtaining the whole knowledge and skill. The purpose of this research was to find out the implementation of virtual practicum method using PhET simulation on the skill of students' science process in style and movement practicum. The method used in this research was qualitative descriptive applied on students of Madrasah Ibtidaiyah Teacher Education Study Program in the amount of 38 students. The techniques of data collection used in this research were observation and interview. Based on the data obtained, then the indicators of science process skill which could run well during the virtual practicum were observation, conducting communication, planning the experiment, and using the tool, material, and source. Overall the result of virtual practicum method implementation assisted by PhET simulation in science learning was in quite good category.

Keywords: Science Process Skills, Virtual Practicum, Science Learning, PhET.

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INTRODUCTION

Face-to-face meetings are limited even after the learning process is functioning regularly, owing to the prevalence of hybrid learning since the pandemic. Educators must integrate technology into learning so that the breadth of content and skills taught is much bigger and more up-to-date to stay up with the times. Inadequate computer literacy skills, a lack of time, and a lack of knowledge among students are some of the issues that arise with hybrid learning (Makhin, 2021). The criteria listed above are all intimately related to the success of the teacher's methods in the classroom teaching and learning process.

Various learning approaches can be used in learning. The method employed is tailored to the learning model, material, and student characteristics. The practicum technique is one of the most widely utilized methods in science learning for certain materials that demand students' skills. Practicum activities are significant for science learning since the materials they contain are based on observations and classifications of facts from everyday life. Every science learning topic should be taught in the laboratory as a practicum so that students may better understand scientific concepts (Ramdhayani et al., 2022).

According to the study's findings (Anggrella et al., 2021), 87.3% of students indicated that lectures on science learning during the pandemic were less effective because of a lack of lecturer inventiveness in selecting relevant learning strategies for practicum activities. Wardhani et al. (2020) believe that implementing practicum is critical for increasing students' interest in and knowledge of science subject matter. Basic practicums can be carried out both in class and in the laboratory; materials can be kept as simple as possible by using tools and materials that are safe, inexpensive, and easy to find in everyday life, allowing students to engage fully in practical activities.

In the online learning era of 2021, the lecture approach for MI/SD Science Studies and Learning at IAIN Palangka Raya employs remote practicums by exploiting the natural settings where students dwell. However, not all concepts can be approached in the same way. Most students find it challenging to conduct practicums for material that necessitates full laboratory equipment and intensive communication among group members, even from a distance.

Not just during online learning, but even when lectures are running normally, students do not yet have access to lab facilities with full science practicum instruments. Thus, we require an application that may be utilized online or offline to meet the needs of student practicum. Besides, the applications are expected to be used independently or in groups

The abilities developed by students during the practicum phase present the next challenge. There are still concerns that using virtual practicum applications in science learning will have an impact on students' science process abilities, which in turn will lead to student learning outcomes in both the cognitive and psychomotor domains.

Practicum implementation is a real-world learning activity carried out by students to create science learning experiences (Satriani et al., 2018a). Students' science process skills can be developed in a practicum, resulting in scientific findings and making learning activities more relevant (Khery, Pahriah, ..., et al., 2019). Practicum can also be utilized to develop students' psychomotor, cognitive, and affective skills in the development of science process skills. During the practicum process, students can carry out activities such as observing, describing data, observing, planning practicums, using tools and materials, and expressing the outcomes of their practicum (Suryaningsih, 2017a).

Students should be able to develop scientific goods through a succession of scientific processes, which is extremely significant for students' children as a reference in carrying out the teaching and learning process. Students must also be able to master the scientific method and its scientific nature, in addition to understanding scientific concepts. Science process skills are all scientific skills that lead to growth and development by requiring students to process information and facts obtained, as well as strengthen imagination and creativity in the use of learning material delivered by the teacher during the practicum process (Resmini et al., 2021). This ability refers to the fundamental potential that students already possess.

Virtual or online practicum methods are one of the ideal strategies to employ in online learning. According to Elisa et al. (2022) Virtual Laboratory is a system that can be used in full in learning or to support conventional practicum systems and can minimize errors during real practicums to avoid various losses such as work accidents or damage to tools and materials used in practicums. As a result, even when the pandemic continues, students can continue to perform practical practicums as usual (Jaya, 2012). This is why the author is interested in utilizing discussion material for study on virtual practicum science process skills.

Through practicum learning activities, students will know more about students' abilities and test students' abilities further on the material being taught, students also more easily understand practicum learning activities(Yurmanalis et al., 2022). The practicum is crucial in learning science since it allows students to strengthen applied science process skills and scientific attitudes to acquire knowledge (Putri et al., 2019).

According to Funks (Citrawathi et al., 2016), research skills should be taught because they can help students develop knowledge and skills. This is critical in assessing students' capacity to process science in the natural sciences. Evaluation is a form of assessment that is used to judge the level of success of a training plan, education, or training that has been completed. The best strategy to get evaluation outcomes is to first assess what you want to achieve (Muliani et al., 2021).

The practical technique will make teaching and learning activities more concentrated and real, and students will be able to discuss learning material with friends to get suggestions, major points, or new concepts. According to Hurrahman (Balram, 2017)), the practicum approach is used so that students may demonstrate the truths of the applicable concepts and so that students can gain satisfaction from their hard study effort.

The benefits of virtual practicum are that students can repeat practice on the material they do not understand, they can reduce the risk of trial activities that can endanger students, they can shorten the time of activities while in the laboratory, and they can save money on purchasing the necessary materials. In addition to their benefits, virtual practicums have some drawbacks, such as a lack of skill experience when practicing in a laboratory, which can result in injury to students, a lack of experience in researching living things, a lack of teacher supervision, and sometimes the

technology in schools is insufficient to carry out practicums in laboratories directly (Widodo, Ajeng Maria, et al., 2016).

One area of virtual practicum that has received less attention is the benefits of virtual practicum in enhancing students' thinking skills. One of the most crucial talents that students must have and perfect is creative thinking. The virtual practicum alluded to here is one established successfully at the University of Colorado using a PhET simulation. There are numerous benefits to adopting PhET simulations, one of which is the attractiveness of the display of PhET simulations, which entices students to use them. PhET also provides interesting, interactive images that can be connected between concepts and real-life events and displays visual images that are difficult for students to understand (Verdian et al., 2021a).

Based on the description above, students can conduct virtual practicums using modern technology without having to meet face to face. The virtual practicum employed in this study was a PhET simulation, and the PhET simulation made it easier for students to develop virtual science process skills. The purpose of this research is to determine the impact of the virtual practicum approach employing PhET simulation on the science process abilities of PGMI IAIN Palangka Raya students studying force and motion.

METHOD

Describe This study is an example of descriptive qualitative research. This study generated 11 items related to science process skills. This study included 38 Madrasah Ibtidaiyah Teacher Education students studying Natural Science Studies and Learning MI/SD IAIN Palangka Raya.

Data for this study were gathered through observation and interview methodologies. The researcher employed a research instrument in the form of an observation sheet in the first stage of the study to explain the stages of activities in the classroom when learning occurred. In the second stage, the researcher employed an interview instrument and asked 8 respondents questions about virtual science process skills. The instrument indicators used in this study adapted instruments from Tawil (Yati Lestari & Diana, 2018) which consist of 11 indicators that can be observed in Table 1.

Table 1. Observation Indicators of Science Process Skills

No	Indicator
1	Observation
2	Classification
3	Interpretation
4	Prediction
5	Communication
6	Making Question
7	Proposing Hypothesis
8	Planning Experiment/Investigation
9	Using tool, material, or sources
10	Conceptual implementation
11	Conducting Experiment/Investigation

The interview instruments used to complement the observation method were in the form of questions related to processes, constraints, and students' perceptions of using the PhET application.

RESULTS

The findings of a study conducted on 38 PGMI IAIN Palangka Raya students for the 2021-2022 Academic Year, by getting the results of observations of Science Process Skills (SPP), are as follows:

Table 2. The Indicators of SPP

No	Indicator	Question	Description
1	Observation	Using sight sense Presenting relevant result	Good
2	Classification	Recording each observation separately Searching for difference, equation Contrasting traits	Fair
3	Interpretation	Giving conclusion	Fair
4	Prediction	Expressing what is possible to occur in an event that does not happen yet	Poor
5	Communication	Describing data the result of experiment using table or graph Arranging and delivering the report clearly Explaining the experimental result	Good
6	Making Question	Questioning to ask for explanation/proposing question which hypothetical background	Fair
7	Proposing Hypothesis	Realizing that one explanation needs to be tested for its truth	Fair
8	Planning Experiment/Investigation	Determining the tool, material, and source that will be used to determine what will be managed, observed, and recorded Determining what will be implemented in the form of work stages	Good
9	Using tool, material, or source	Using the tool, material, or source Knowing why using tool, material, and source	Good
10	Concept Application	Using the concept which had been learned in new situation	Fair
11	Conducting Experiment or Investigation	Using the concept to do experiment or investigation	Fair

To build students' scientific skills, the 2013 curriculum emphasizes learning physics using a process skills method (Ilmi et al., 2016). The findings of this test's observation data reveal the best scores on the markers of observing/observing, communicating, arranging experiments/investigations, and employing tools, materials, or resources to achieve good

outcomes. To obtain sufficient findings, it is necessary to group/classify indicators, interpret (interpret), ask questions, offer hypotheses, apply concepts, and execute experiments or studies. The same thing can be found in the research conducted (Lumbu et al., 2018) in describing the skills of physics teachers when implementing KPS, with the results obtained indicating that aspects of KPS were successfully carried out in most of the basic competencies, specifically in the aspect of observing (observation) and using tools and ingredients. Science knowledge, according to (Budi et al., 2019) comprises concepts and principles that are often difficult for students to understand; consequently, teachers must use learning media in their classrooms. PhET can be used to provide student-centered learning by directly engaging students.

This PhET simulation was chosen because this simulation is based on a Java program which has the advantage of facilitating the task of teachers in making science simulations using computers according to their field of knowledge. According to Yuanita (Ramadhani et al., 2019), Forecasting/prediction skills can train students to make predictions about something that has not happened based on a trend. This indicator has not been implemented properly in the application of virtual practicum. So, on the results of the overall data obtained in the implementation of the IAIN PGMI IAIN Palangka Raya practicum on force and motion material, the average category average was sufficient.

The results of student interviews on virtual scientific process abilities in science learning on force and motion connected to the use of PhET simulations. There were ten questions in the interview about the deployment of virtual science process skills learning and the use of PhET simulations. Eight students were questioned. The interview results regarding students' interest in virtual practicums were as follows: "Yes, they are interested, because with this virtual practicum it is easy to do virtual practicums due to our current situation, namely Covid-19, so carrying out direct practicums is not possible, but because that virtual practicum is very suitable for our current situation, so I am interested in doing this virtual practicum." Because conditions do not permit direct practicum, virtual practicum facilitates practical science learning. As a result, the virtual practicum is ideal for the current circumstances.

Aside from making online learning easier, virtual practicums make it easy for schools/campuses that lack complete laboratory equipment to employ virtual laboratories. As a result, the desired learning objectives can be met without the need for full laboratory equipment (Alatas, 2018). PhET also displays visual pictures that are difficult for pupils to understand and gives engaging, interactive graphics that can be connected between concepts and real-life events (Verdian et al., 2021a). However, the virtual laboratory cannot be described as ideal because it still has flaws and limitations. According to research (Suryanda et al., 2017), when performing a practicum utilizing a virtual laboratory, there are system faults caused by either the program or the internet network.

Besides, the virtual laboratory offers only sound and no instructions on how to utilize it. Students are generally interested in doing this virtual practicum since it is easier to carry out even at home, at any time, and it is more efficient to complete a virtual practicum on force and motion material. Furthermore, virtual practicums using PhET simulations make it simple and appealing to students' learning interests, thus students believe that virtual science practicums are not at all boring (Fatimah et al., 2020b). The usage of PhET simulations has several advantages, including being free, fascinating, and participatory, as well as being able to urge students to learn while experiencing genuine learning, even though it is implemented digitally (Febrianti & Nuraini, 2020)According to the results of interviews with various students, the use of PhET simulations is like a children's game since some visuals and animations can be changed, which can draw students' interest and make virtual practicum simpler.

According to research (Rupawanti, 2020), PhET simulations are packaged in the form of listening views that can explain materials that are still abstract for students, not only as PhET simulation media but can be used according to the needs of teachers and students, the advantages of the other as a virtual laboratory that is used without having to do practical work in the laboratory room.

The utilization of virtual practicums can have an impact on the learning process. The learning process is usually done in person, although it is now being done online. This has an impact

on the learning process, requiring students and teachers to learn how to adapt learning tools and procedures in the classroom (Ariani & Widodo, 2022a). According to students, the challenges associated with doing virtual practicums include issues when the internet network is disrupted and not good enough, which can lead to difficulties in conducting virtual practicums using PhET simulations.

One advantage of employing PhET simulations to perform virtual practicums is that it lowers geographical obstacles (R. alfarizi Kurniawan et al., 2020). Because in this implementation, students are divided into many groups, one of which includes students from various houses, which means they complete practicums in their own homes. Nonetheless, they were assigned by the group leader to do practicums and subsequently report on the outcomes of those activities. If a group member doesn't understand how to use it, a friend who does will explain it to him, or an instructional video for using the PhET application can be made, or instructions can be given via voice message on WhatsApp. A virtual practicum using the PhET program can help students do a practicum at their own homes without having to do the practicum firsthand.

The results of interviews with students related to virtual science process skills and the use of PhET simulations for PGMI IAIN Palangka Raya students totaling 38 students of the Science course subject to force and motion fall into the good category, even though some of the students experienced difficulties when using PhET simulations. Whether due to network constraints or a lack of understanding of how to use PhET simulations. The limits that arose, however, did not diminish students' interest in using PhET simulations in their virtual practicums.

CONCLUSION

The implementation of virtual science practicum for PGMI IAIN Palangka Raya students for force and motion material utilizing the virtual practicum method employing PhET simulation on science process skills demonstrates that it is fairly good. The skill of forecasting/predicting in the "very poor" category is one of the Science Process Skills that cannot be gained by the use of the PhET virtual practicum.

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