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How Are The Portrays And Perceptions Of Students In Physics Experiment?

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Abstract. Science learning is inseparable from practice activities or experiments. A laboratory is a facility to promote these activities. During distance learning, laboratory activities could be promoted at home. This research aims to portray the students' activities during the laboratory practice and to find out the students' perceptions about the laboratory practice and take-home laboratory practice. The applied method was a survey followed by 80 physics education students of Universitas Pattimura. This research also interviewed three lecturers of the program. Before distributing the questionnaire, the question items were validated in terms of the content. Then, the researchers also examined the reliability of the questionnaire. The findings showed that students did the laboratory practice as they frequently did. They started by having a pretest and ended with a posttest. They also created temporal reports and practical reports for the following meetings. The students were interested in the practice activities because they believed these activities could make them having various skills. Some students recognized the term, take-home practice, by using any surrounding tools and materials. However, most students still considered that laboratory activities should have been done in the laboratory.

Keyword: physics experiment, laboratory, take-home laboratory

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INTRODUCTION

At the beginning of the 18th century, educators and researchers had studied the value of practical performance and its importance within scientific fields, such as chemistry and biology. (Wardani et al., 2017) State that laboratory activity is very useful for learning science. Many studies showed that a practical job had many benefits to develop laboratory skills and scientific knowledge and to understand the science concepts and theories (Mohd Fadzil & Mohd Saat, 2013; Schwichow et al., 2016). The practical job or practice could improve the positive attitudes and learning motivation of students effectively in learning science (Okam & Zakari, 2017). The positive attitude was known to have a positive correlation toward the practical job or practice that influenced students' science achievements (Hinneh, 2017). The laboratory jobs play important roles in science education (Hofstein & Lunetta, 2004; Hofstein & Mamlok-Naaman, 2007). A laboratory environment refers to an environment where the theoretical knowledge is examined and various experiments are conducted. This environment facilitates the empowerment of what is being learned (Lacey et al., 2020). The skills of home class teachers to design and promote laboratory activities depend on their education during their undergraduate degrees. The skills to use the developed laboratory during the bachelor degree facilitate the home class teachers to teach practical knowledge in their professional lives. However, the performed science learning in the laboratory will attract the students' attention and allow them to promote sustainable learning via experiments (Che Ahmad et al., 2017). The objectives of the practical jobs are to improve the students' understanding, develop their problem-solving skills, and understand the scientific natures by modeling the scientists' actions. (Sotiriou et al., 2017) states that scientific-problem solving allows learners to act as scientists. It also requires them to follow the scientific process. (Tsakeni, 2018) found that laboratory activities encouraged the learners' science confidence. The lesson of laboratory practice taken by the teacher candidates during the bachelor degree influenced significantly their skill developments (Shapiro et al., 2015).

Laboratory activity is a psychomotor activity to train the students' professional skills (Weatherby-Fell et al., 2019). The previous students' learning experiences are also important for laboratory activities (Betawi & Jabbar, 2019). Laboratory activities also require specific training to achieve certain skills (Ben-Harush & Orland-Barak, 2019). (Mattsson et al., 2011) argue that laboratory practice refers to the moment a teacher and students cooperate in the laboratory while the other peers assist them to be excellent students. Thus, teachers have the responsibility to monitor and help the students during the laboratory activities (Ben-Harush & Orland-Barak, 2019). In laboratory activities, teachers have the role of practitioner or expert in a certain field. Thus, they must guide the students to reach learning success (Agbenyega, 2012; Allen, 2011; Gibbons et al., 2018).

The take-home experiment uses take-home tools and materials. This experiment is proposed as the alternative to a laboratory experiment (Kennepohl & Last, 2006; MacQueen & Thomas, 2009). Improvisation is a pedagogical intervention by teachers. They can use it to handle a similar situation by becoming an initiator to create or to use the local materials, tools, and conventional tools. It is important when they deal with difficulties, such as lack of facilities or the non-availability of materials (Inyega & Tompson, 2002). The low-cost materials produced by improvisation are not the efforts to provide cheap science education. However, it has the function to encourage creativity and productivity, providing opportunities, developing skills and manipulative concepts, and learning and internalize the job concretely. Thus, this effort will be much better than promoting chalk-lecture classes for science subjects (Yitbarek, 2012). (Bhukuvhani et al., 2010) argued that practical activities or practice could be applied by using simple take-home experiments and low-cost experimental kits.

METHODS

This research aims to portray the students' activities during the laboratory practice activities and to find out the students' perceptions about the activities. This research used a survey method. The researchers involved 80 physics students of Universitas Pattimura. The instrument was a questionnaire with a Likert scale. There were two types of Likert scale used in this research. The first one was to portray the students' activities during the laboratory practice. It consisted of 19 questions. The researchers arranged 18 questions to find out the students' perceptions about the practice. Before distributing the questionnaire, it was validated with a Forum Group Discussion and Aiken's validity. The instrument reliability was measured to determine the consistency of the measurement.

RESULTS AND DISCUSSION

The Instrument Validity and Reliability

Validity refers to the capability of an instrument to produce stable and consistent results. This research used Aiken's validity with seven raters. Every rater showed that each item of the questionnaire could be used for research purposes. (Aiken, 1985) argue that if the validity test is done with seven raters and there are five options in the applied scale, the validity score must be higher than 0.8. The averages of Aiken's validity for the students' activity portray dealing with laboratory and their perceptions about laboratory practice were 0.89 and 0.92. It meant each question item was valid for research purposes. The internal consistency and the reliability of the repeated test are defined as the main two types of reliability evidence. They also cover parallel form reliability and inter-rater reliability. The internal consistency reliability refers to the reliability magnitude applied to evaluate the capability of different test items to investigate the same construct that leads to the same results. It is usually measured with Cronbach Alpha. The reliability estimation for the students' activity questionnaire portray in the laboratory and their perception about the laboratory activities were 0.91 and 0.89. Thus, the questionnaires were reliable to use because the estimation result was higher than 0.6.

The Portray of Practices

The laboratory activity is crucial to do because physics emphasizes scientific skills, attitudes, and products. This activity allows students to skillfully use the tools and instruments, to prove the cause-effect correlation, and to explain a natural phenomenon. Every student has a different experience during the interaction with the chemistry laboratory environment. The students' experience could be used as the information to find out their portrays while they were in a physics laboratory environment. The research results about the students' portray could be seen in Table 1.

Table 1. The Portrays of Students' Activities in Laboratory

Dimensions	Average
Laboratory-technical activity	4.40
Facility and infrastructure	4.34
Motivation and skill	4.53

The laboratory technical activity

The technical activity dimensions in the laboratory revealed various promoted activity types. They were usually realized in regulations or technical directions in the laboratory. The clarity of regulation is the dimension to see how regulation is promoted during laboratory activities. In the laboratory, it requires regulation to regulate the tool or instrument mechanisms because the laboratory is a place of experimentation. Thus, it is susceptible to any accidents. For example, the chemical laboratory has many hazardous and flammable materials. Therefore, it needs clear regulations to avoid any accident administratively and physically. In this case, regulation becomes the tool to create a secure condition in the laboratory. The students' portray score toward the regulation clarity dimension is 4.40. It proved that the applied regulation and the environmental clarity were excellent. One of the technical activities in the laboratory is a pre-test. The pre-laboratory preparation could improve the security in the class from various hazards and risks. These could be explained and understood before starting the practicing session (Loveys & Riggs, 2019).

Facility and infrastructure

The portray score of the students' laboratory activities within the facility and infrastructure dimension was 4.34. It showed that the facility and infrastructure were reliable to use for practice purposes. Physics is a science that involves practice or practical activities. (Ojediran et al., 2014) Observed that the most important feature of effective physics teaching was to support theoretical explanation with real practice or practice in the laboratory. Thus, physics teaching at Senior High School should develop important scientific skills for learners so that they could internalize them into their creative thinking. This matter is useful to improve their technology applications. Therefore, students or learners need complete laboratory facilities to learn how to teach physics practice effectively (Olugbenga & Thomas, 2014). This notion is also supported by (Danjuma & Adeleye, 2015). They found that ineffective use of laboratory tools caused poor performance of students. (George, 2017) also found some schools had difficulties carrying out the laboratory activities if the facility and infrastructure were insufficient.

Motivation and skill

The practical activities in the laboratory within the dimension of motivation and skill obtained a score of 4.53. The score showed that the students had high motivation while participating in laboratory activities. The experience of using the laboratory allowed students to directly interacted with the things they learned in textbooks (Olympiou & Zacharia, 2012). The science students could understand that the experimental results were not always as expected. The classes of laboratory practice allow active and direct learning. (Freeman et al., 2014) found how to use the experience nature of practice class and added value by encouraging students to deal with the activity. It would make them participating deeper with the theory, context, and relevance with certain practices in laboratory sessions. The theoretical and practical learning models were interchangeably done. It was an effective way to create meaningful learning (McLean et al., 2016). (George-williams et al., 2020) Found that laboratory activities made students studied about time management, teamwork, autonomy, autonomous learning, and problem-solving or cortical thinking.

The Students' Perceptions about Laboratory Activity

The previous practice activities were popular to do in an indoor was a laboratory. In this pandemic, many laboratories closed their access to support the preventive efforts to severe the disease. With the technology development, the practice or practical activity could be done anywhere. The outdoor laboratory practices have not been popular. However, studies showed that some students have recognized the term *take-home laboratory*. The results of the students' perceptions about the practice (Table 2).

Table 2. The Students' Perceptions about Practice

Dimensions	Average
Laboratory practice	3.97
Take-home laboratory practice	3.49

Laboratory practice

The score of the students' perceptions about practice within the dimension of laboratory activity promotion was 3.97. It showed that the laboratory was the main place to do the practice. The scientific investigation procedure that should be met was the inseparable aspect from the activity. Some studies about students' perceptions about laboratory experimental objectives were done. (DeKorver & Towns, 2015) found that students in the chemical laboratory tend to focus on objective affections, such as task completion in a brief time to get scores. (George-Williams et al., 2018) found that the students felt enjoy doing the practice activities in the laboratory because they were useful to develop their theoretical understanding and skills later in the working world.

Take-home laboratory practice

(Turner & Parisi, 2008) reviewed the take-home practice activity to teach physics for the first-year students in campus and distant learning. However, this strategy was applied for adult learners and the measuring instrument of the experiment was relatively large. (Zimmerman, 2012) conducted a qualitative study about students' participation in an observational inquiry activity at home. (Gendjova, 2007) conducted a study about the influence of chemical experiments at home to improve the students' interest in learning chemistry. Many books also mentioned scientific activity at home especially about science in the kitchen. However, the study has not proved explicitly how the integration of science activity in the classroom was in line with science activity at home. The score of the students' perceptions about the practice within the dimension of practice activity at home was 3.49. It showed that the students had recognized the practice terms at home but they were not familiar yet. According to (Zulirfan et al., 2017), the take-home practice strategy was suitable to promote scientific attitudes compared to a laboratory experiment. This method provided more freedom for the students to conduct scientific activities.

CONCLUSION

A laboratory is a facility to train psychomotor competence. It allows learners to do an experiment and to apply the same pattern for technical matters. For example, the practice was initiated with a pretest and ended with a posttest. The students collected the data, made the temporal report, and reported the findings in the following meeting. Portrays of the laboratory practice were full of the existence of the laboratory assistants to help the activities. The students were also enthusiastic in the practice. Dealing with the student's perceptions about the practice place, the students mostly answered in the laboratory. The students were not familiar with the term take-home laboratory although they had done it. Take-home laboratory could be the bridge of the practice implementation during distant learning.

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