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Students' Perceptions of Physics Laboratory Utilization in Supporting Physics Learning at SMA Negeri 8 Pekanbaru

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Abstrak- The physics laboratory plays an important role in supporting physics learning by providing students with opportunities to understand concepts through practical activities. The effectiveness of laboratory utilization is determined not only by the availability of facilities but also by students' perceptions of their learning experiences. This study aimed to evaluate the utilization of the physics laboratory in supporting physics learning based on students' perceptions at SMA Negeri 8 Pekanbaru. The study employed a descriptive quantitative approach using a survey method. Data were collected through a questionnaire consisting of 30 statements covering laboratory utilization, availability of equipment and materials, practical implementation, student involvement, benefits of practical activities, practical constraints, and laboratory conditions and safety. The respondents were 84 students from Grades X and XI selected through purposive sampling. Data were analyzed using descriptive percentage techniques. The results indicated that physics laboratory utilization was categorized as good to very good. The highest percentage was obtained for the benefits of practical activities (89%), followed by student involvement (88%) and laboratory conditions and safety (83%). Meanwhile, laboratory utilization, practical implementation, and availability of equipment and materials obtained 78%, 80%, and 75%, respectively. Practical constraints received the lowest percentage (65%). It can be concluded that the physics laboratory has been well utilized and contributes positively to students' conceptual understanding, learning motivation, and science process skills. However, improvements in laboratory facilities and practical management are still needed to optimize its benefits

Keywords: physics laboratory, physics learning, laboratory utilization, students' perceptions, physics practical work.

1 Introduction

In addition to facilities, students' perceptions of laboratory utilization play an important role in determining the success of practical-based learning. Perception is a cognitive process involving an individual's interpretation of acquired experiences (Robbins & Judge, 2017). In an educational context, students' perceptions can influence their attitudes, motivation, and engagement in learning activities. Students' perceptions of practical activities are therefore an important factor in successful physics learning. Students who have positive learning experiences through practical work tend to develop greater interest in physics. Practical activities can provide enjoyable learning experiences and enhance students' learning motivation (Osborne & Dillon, 2008). Moreover, practical activities enable students to connect abstract physics concepts with real phenomena that they observe directly. Conversely, when practical activities are not implemented effectively, students may become less interested and may not obtain optimal learning benefits. Evaluation of laboratory utilization is a systematic process for assessing the level of laboratory use, the availability of facilities and infrastructure, the effectiveness of practical activities, and their contribution to achieving learning objectives (Stufflebeam & Shinkfield, 2007; Arikunto & Jabar, 2018). Through

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evaluation, schools can identify aspects that are functioning well and those that still require improvement, thereby enabling more effective laboratory management. Although numerous studies have discussed the use of physics laboratories in learning, most have focused on particular aspects, such as the completeness of laboratory facilities, the effectiveness of practical activities, or their impact on student learning outcomes (Awitaningsih et al., 2012; Rafiqah et al., 2023). Studies comprehensively evaluating physics laboratory utilization based on students' perceptions remain relatively limited, particularly at the senior high school level in Pekanbaru. Furthermore, studies integrating laboratory utilization, equipment and material availability, implementation of practical activities, student involvement, benefits of practical work, implementation constraints, and laboratory conditions and safety within a single evaluation framework are still uncommon. Therefore, research is needed to provide a more comprehensive picture of physics laboratory utilization as a means of supporting physics learning in schools.

Based on the preceding discussion, physics laboratory utilization plays a highly important role in improving the quality of learning. However, several constraints must still be addressed to optimize laboratory use. One approach is to analyze students' perceptions of laboratory use in learning. This study was conducted at SMA Negeri 8 Pekanbaru, a school equipped with a physics laboratory. The study aimed to evaluate the utilization of the physics laboratory in supporting physics learning based on students' perceptions at SMA Negeri 8 Pekanbaru. The evaluation covered laboratory utilization, availability of equipment and materials, implementation of practical activities, student involvement, benefits of practical activities, implementation constraints, and laboratory conditions and safety. The findings are expected to provide evaluation material for improving the quality of practical-based physics learning at school.

2. Research Methodology

The research instrument was a questionnaire measuring students' perceptions of physics laboratory utilization in supporting physics learning. The questionnaire was developed based on physics laboratory utilization indicators adapted and modified from previous studies on the evaluation of physics laboratories in learning, including Awitaningsih et al. (2012), Rafiqah et al. (2023), and Sari and Roza (2020). The instrument consisted of 30 statements covering laboratory utilization, availability of equipment and materials, implementation of practical activities, student involvement, benefits of practical activities, constraints in conducting practical work, and laboratory conditions and safety.

Table 1. Research Indicators Research Design

Variable	Indicator	Sub-indicator
Evaluation of Physics Laboratory Utilization	Laboratory Utilization	Frequency of laboratory use, alignment of practical activities with learning materials, readiness of equipment and materials
	Availability of Equipment and Materials	Completeness of practical equipment, equipment condition, availability of practical materials
	Implementation of Practical Activities	Clarity of practical procedures, ease of implementation, organization of practical activities
	Student Involvement	Student activeness, group collaboration, participation during practical activities
	Benefits of Practical Activities	Understanding of physics concepts, increased learning interest, experimental skills
	Practical Constraints	Limited equipment, limited time, obstacles during practical activities

Each statement was measured using a five-point Likert scale, as presented in Table 2.

Table 2. Likert Scale

Score	Category
5	Strongly Agree
4	Agree
3	Moderately Agree
2	Disagree
1	Strongly Disagree

The participants were Grade X and XI students at SMA Negeri 8 Pekanbaru who had participated in physics practical activities in the school laboratory. A total of 84 students were selected using purposive sampling. This technique was employed because the respondents had prior experience participating in physics practical activities and were therefore able to provide relevant information regarding physics laboratory utilization in supporting the learning process.

Because the research instrument was adapted and modified from instruments used in previous studies, this study focused on collecting and analyzing students' perception data concerning physics laboratory utilization in learning. Questionnaire data were analyzed using descriptive percentage analysis to describe the level of physics laboratory utilization for each investigated indicator.

3. Results and Discussion

3.1 Results

This study aimed to evaluate physics laboratory utilization in supporting physics learning based on students' perceptions at SMA Negeri 8 Pekanbaru. Data were obtained by administering a questionnaire to 84 students who had participated in physics practical activities in the school laboratory. Descriptive percentage analysis was used to determine the level of physics laboratory utilization for each investigated indicator, including laboratory utilization, availability of equipment and materials, implementation of practical activities, student involvement, benefits of practical activities, practical constraints, and laboratory conditions and safety. The percentage results for each indicator are presented in Table 3.

Table 3. Percentage of Physics Laboratory Utilization Based on Students' Perceptions

No.	Indicator	Percentage (%)
1	Laboratory Utilization	78
2	Availability of Equipment and Materials	75
3	Implementation of Practical Activities	80
4	Student Involvement	88
5	Benefits of Practical Activities	89
6	Practical Constraints	65
7	Laboratory Conditions and Safety	83

Physics Laboratory Utilization in Learning

The results showed that physics laboratory utilization at SMA Negeri 8 Pekanbaru reached 78% and was categorized as good. This finding indicates that the physics laboratory has been utilized as a learning support facility, particularly for practical activities relevant to the material studied in class. Most students reported that practical activities helped them understand abstract physics concepts through direct experience. Laboratory use enables students to conduct observations, measurements, and concept testing, making the learning process more meaningful. Nevertheless, the percentage, which did not reach the very good category, indicates that laboratory utilization can still be improved. Not all physics topics can be addressed through practical work because of limitations in equipment, time, or the characteristics of particular topics. This finding is consistent with Awitaningsih et al. (2012), who reported that physics laboratories were well utilized but had not yet accommodated all practical needs in physics learning.

Availability of Practical Equipment and Materials

The availability of equipment and materials obtained a percentage of 75% and was categorized as good. This result indicates that, in general, laboratory facilities were available and could support practical activities. Adequate equipment and materials are important for successful laboratory-based learning because they enable students to gain more optimal learning experiences. However, some students considered the number of practical instruments insufficient for simultaneous use by all groups. Consequently, students had to take turns using equipment, reducing the efficiency of practical sessions. This finding supports Wati et al. (2023), who showed that the completeness of laboratory equipment significantly influences the quality of physics learning. The more complete the available laboratory facilities, the greater the opportunity for students to obtain optimal experimental experiences.

Implementation of Practical Activities

The implementation of practical activities obtained a percentage of 80% and was categorized as good. This result indicates that practical activities were conducted systematically in accordance with the planned learning objectives. Most students stated that the practical instructions were easy to understand and that the experimental procedures could be carried out effectively.

Practical activities provide students with opportunities to test theoretically learned concepts through experimentation. From a constructivist perspective, the direct experiences students gain during practical work play an important role in knowledge construction. Through observation and analysis of experimental data, students can develop deeper conceptual understanding than through theoretical classroom instruction alone. The findings also indicate that practical activities contribute to the development of science process skills, including observing, measuring, processing data, and drawing conclusions based on empirical evidence. Therefore, well-planned practical activities should be maintained and further improved as an integral component of physics learning.

Student Involvement in Practical Activities

The student involvement indicator obtained 88% and was categorized as very good. This result indicates that students participated actively in practical activities. The high level of student involvement suggests that laboratory-based learning can create a more engaging and interactive learning environment than conventional instruction. During practical activities, students engaged in observations, recorded data, discussed findings with group members, and presented experimental results. These activities not only improve conceptual understanding but also develop social skills and scientific communication. The high level of involvement indicates that the laboratory functions as a learning environment that supports active learning. This finding is consistent with twenty-first-century learning principles emphasizing collaboration, communication, creativity, and critical thinking. Practical activities allow students to develop these competencies simultaneously through structured scientific activities.

Benefits of Practical Activities for Physics Learning

The benefits of practical activities indicator obtained the highest score, 89%, and was categorized as very good. This result indicates that students perceived substantial benefits from practical activities in physics learning. Practical work helps students understand physics concepts more easily because they can directly observe the phenomena being studied. In addition to improving conceptual understanding, practical activities contribute to increased student interest and learning motivation. Learning experiences involving direct activity make students more enthusiastic about participating in lessons. Practical work also helps reduce the perception that physics is a difficult and abstract subject. This finding supports Abrahams and Millar (2008), who stated that practical-based learning can improve students' conceptual understanding, critical thinking, and problem-solving skills. Thus, physics laboratories play a strategic role in improving the quality of learning and student learning outcomes.

Constraints in Conducting Practical Activities

The practical constraints indicator obtained 65%, which was categorized as moderate. This was the lowest percentage among all indicators and indicates that several obstacles remain in conducting practical activities. Based on students' responses, the main constraints included a limited number of practical instruments, relatively short implementation time, and a large number of students in each class. These conditions meant that not all students had equal opportunities to conduct experiments directly. Limited time also affected the effectiveness of practical activities. Some experiments require longer periods to obtain optimal results, whereas the allocated learning time is often insufficient. Therefore, more effective laboratory management strategies and additional practical facilities are needed to minimize the constraints experienced by students.

Laboratory Conditions and Safety

The laboratory conditions and safety indicator obtained 83% and was categorized as very good. This result indicates that the laboratory facilities were in good condition and supported safe and comfortable practical activities. Students considered the laboratory environment sufficiently conducive to experimental activities. In addition, occupational safety rules were appropriately implemented, helping minimize the risk of accidents during practical work. Students' awareness of the importance of safety was also relatively high. Good laboratory conditions are an important factor in creating effective learning. A safe and comfortable learning environment increases students' confidence in conducting experiments and supports an optimal learning process

Discussion

The findings indicate that physics laboratory utilization at SMA Negeri 8 Pekanbaru ranged from good to very good. The benefits of practical activities obtained the highest percentage (89%), followed by student involvement (88%) and laboratory conditions and safety (83%). These findings demonstrate that the physics laboratory plays an important role in supporting a more meaningful and student-centered learning process. Through practical activities, students not only develop better conceptual understanding but also have opportunities to strengthen science process skills, such as observing, measuring, analyzing data, and drawing conclusions based on empirical evidence. This result is consistent with Hofstein and Lunetta (2004), who stated that laboratories are an important component of science education because they can improve students' conceptual understanding and scientific skills. The results are illustrated in Figure 1.

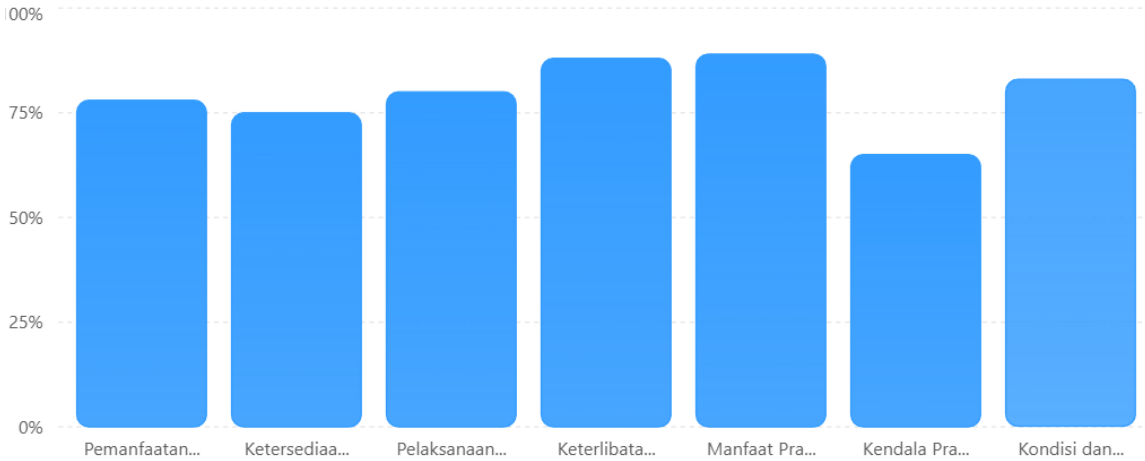

Figure 1. Percentage of Physics Laboratory Utilization

The high percentage for student involvement indicates that practical activities effectively encourage active student participation during the learning process. Practical work provides students with opportunities

to discuss, collaborate in groups, and solve problems collectively. This finding supports Trilling and Fadel (2009), who argued that laboratory activity-based learning can develop twenty-first-century skills, particularly critical thinking, communication, and collaboration.

Nevertheless, the practical constraints indicator obtained the lowest percentage (65%). This finding indicates that obstacles remain in conducting practical activities, particularly those related to limited equipment and materials and the available time allocation. This result is consistent with Wati et al. (2023), who reported that the completeness of laboratory facilities is an important factor influencing the effectiveness of physics learning. Therefore, improvements in laboratory facilities and more effective management of practical activities are needed so that all students can obtain optimal benefits from laboratory learning.

4. Conclusion

T Based on the findings, it can be concluded that physics laboratory utilization in supporting physics learning at SMA Negeri 8 Pekanbaru was categorized as good to very good. The analysis showed that the benefits of practical activities obtained the highest percentage at 89%, followed by student involvement at 88%, indicating that practical activities positively contribute to students' understanding of physics concepts, learning interest, and development of science process skills. In addition, laboratory utilization, availability of equipment and materials, implementation of practical activities, and laboratory conditions and safety were also categorized as good to very good, indicating that the laboratory has been utilized relatively optimally as a learning support facility.

Nevertheless, several constraints remain in conducting practical activities, as indicated by the practical constraints score of 65%. These constraints mainly concern limitations in practical equipment and materials and the available implementation time. Therefore, efforts are needed to improve laboratory facilities, strengthen the management of practical activities, and optimize laboratory utilization to support higher-quality learning. Overall, the physics laboratory plays an important role in creating active, meaningful, and student-centered learning and should therefore continue to be developed to improve the quality of physics education in schools..

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