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Profile of High School Biology Laboratory Management in Lahat Regency Based on Laboratory Management Standards

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Abstract: This study aims to describe the profile of high school biology laboratory management in Lahat Regency in terms of completeness of facilities and infrastructure, environmental conditions, administrative completeness, and occupational health and safety. The method used in this research is descriptive qualitative method. The research sample consisted of 5 A-accredited high schools in Lahat Regency. Data were collected through questionnaires for laboratory heads and direct observation. The results showed that the profile of biology laboratory management in high school in Lahat Regency which includes components of Completeness of Facilities and Infrastructure is classified as quite good and quite complete, laboratory conditions are categorised as very good and complete, administrative completeness is good but less complete and the category of occupational health and safety in the laboratory is very good and complete. The management of high school biology laboratories in Lahat Regency shows excellence in the use of storage space for tools and materials, but there are obstacles in the completeness of facilities and infrastructure, such as inadequate preparation and administration rooms. Laboratory conditions are generally quite good, although ventilation and water availability still need improvement. Laboratory administration is not well organised, especially in terms of SOPs and tool inventory. Occupational health and safety aspects are also limited, with a lack of personal protective equipment and adequate safety facilities. This shows that laboratory management needs improvement to fulfil national standards.

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Introduction

The teaching and learning process involves a variety of complex activities, not just the transfer of textual information from educators to learners. Every learning process aims to ensure students master the targeted competencies, including the underlying values and attitudes. Therefore, learning does not always have to take place in the classroom; often learning can take place in the laboratory or in the field, especially for science subjects such as Biology. (Santosa, 2018).

Biology is a scientific discipline that explores living things through the process of investigation or research by utilising the use of scientific methods. (Herlina & Widiyaningrum, 2013).. Biology does not only consist of facts and concepts, but also includes a series of processes and values that can be applied and developed in real situations. One of the main characteristics of learning biology is the acquisition of practicum that can be done in the laboratory or in nature. Given the many complex concepts of biology, it is important to carry out activities that can facilitate student understanding of these concepts.

Practicum provides an opportunity for students to directly understand the theoretical material that has been learned and gain sensory experience. In addition to observation, students are expected to be actively

involved in these activities and be responsible for the results obtained. (Hastuti, 2014). Literally, practicum comes from the word "praktik," which refers to the direct application of the theory that has been explained. Based on the Big Indonesian Dictionary, practicum is a component of the teaching process that intends to provide opportunities for students to test and apply directly the material that has been learned from theory and practical lessons (Agustina, et al., 2017). (Agustina, et al., 2017). Practicum refers to one of the crucial laboratory activities to support the success of the biology learning process. Practicum provides opportunities for students to learn biology through direct observation of symptoms and processes, hone scientific thinking capacity, form and improve scientific attitudes, and identify and solve new problems using a scientific approach (Anggraeni, et al., 2017). (Anggraeni, et al., 2013). Practicum will be effective if all components involved meet the minimum standards set for the implementation of practicum in schools. Permendikbud No. 8/2018 related to Facilities and Infrastructure Standards stipulates that laboratories are important facilities that must exist in every educational institution to support the success of the learning process and practicum activities. (Lestari, 2020).

Laboratories are generally designed to support the implementation of activities under controlled conditions. Laboratories are expected to strengthen the learning process, so that educational goals can be met and student achievement increased. However, in practice, many schools have not utilised the laboratory optimally as a learning tool. (Elseria, 2016). In a narrower sense, a laboratory is usually understood as a room or building equipped with walls and roofs and various tools and materials for practicum (Agustina, et al., 2017). (Agustina, et al., 2017). The main function of the laboratory is to facilitate the learning process to help schools achieve the mission and goals that have been set. The success of laboratory activities depends on three main factors, namely the accessibility of equipment, supplies, and facilities; the competence of laboratory personnel; and the guidance provided by teachers in facilitating students' practical work. (Alatas & Muhtadi, 2013)..

Laboratories in schools function significantly in supporting the learning process to fulfil the achievement of educational goals. With the laboratory, students are expected to be able to understand lessons not only in terms of theory, but also through direct practice. Therefore, laboratory utilisation is one of the important requirements in learning activities or practicum. An effective biology laboratory management system is very important. Laboratory management plays a crucial role in improving the effectiveness of biology learning. The laboratory must always be ready to use, supported by adequate facilities and media, and efficient administration. (Nurlia & Agustina, 2018). Efficient laboratory management requires the presence of a knowledgeable and skilled workforce, such as laboratory heads, technicians, and laboratory assistants, who can carry out their duties and obligations optimally. This is very important because laboratory personnel are responsible for all activities in the laboratory. Thus, laboratory staff in each school must comply with the standards that have been regulated based on Permendiknas Number 26 of 2008 related to School Laboratory Personnel Standards. (Lestari, 2020). Laboratory management in Lahat Regency has never been the object of previous research. So, it is quite essential to carry out this research to evaluate the completeness of infrastructure and facilities, the qualifications of laboratory personnel, the condition of the laboratory environment, the completeness of laboratory administration, and aspects of work safety in high school biology laboratories in Lahat Regency. Therefore, the purpose of this study is to describe the profile of high school biology laboratory management in Lahat Regency in terms of completeness of facilities and infrastructure, environmental conditions, completeness of administration, and occupational health and safety.

Method

The research used a qualitative descriptive method that describes the conditions, situations, circumstances, events and activities related to laboratory management in high schools in Lahat Regency. Qualitative descriptive method was used in this study to describe and analyse the condition of biology laboratory management in high schools in Lahat Regency. Data were collected to obtain information about the completeness of facilities and infrastructure, laboratory conditions, administration, and aspects of occupational health and safety. Data collection was carried out using instruments in the form of questionnaires, and observation. Descriptive qualitative research intends to explain or describe the data in detail and present detailed and comprehensive answers to research questions. In this study, the description includes the completeness of facilities and infrastructure, administrative completeness, environmental conditions, and occupational health and safety in the biology laboratory of Lahat Regency high school.

This research went through three stages: preparation, implementation, and completion. The preparation stage includes determining the sample of schools to be studied, making research instruments in

the form of questionnaires and observation sheets. The implementation stage involves the introduction of the researcher and the delivery of the research objectives, administering questionnaires to the head of the laboratory and observing the biology laboratory according to the observation sheet of facilities and infrastructure and environmental conditions. The completion stage includes processing questionnaire and observation data

Furthermore, the data obtained was analysed qualitatively by identifying patterns, grouping relevant information, and providing in-depth descriptions of each category studied. Analysis of questionnaire and observation data was carried out with percentage results using the formula, namely:

$$\textbf{\textit{Percentage}} = \frac{n}{N} x100$$

Description:
n = Number of marks obtained
N = Maximum number of marks

The results of the percentage of data analysis obtained will be adjusted into five categories which can be seen in Table 1.

Table 1. Categories of Questionnaire and Observation Data

Percentage (%)	Category
81 - 100	Very good
61 - 80	Good
41 - 60	Good enough
21 - 40	Less good
0 - 20	Not good

Result

The data of this study were taken based on the profile of laboratory management in Lahat Regency in accordance with Permendiknas No. 27 of 2007 and Permendikbud No. 8 of 2018 concerning Biological Laboratory Facilities and Infrastructure Standards and Permendiknas No. 26 of 2008 concerning School Laboratory Personnel Standards. The aspects of laboratory management include the completeness of facilities and infrastructure, environmental conditions, administrative completeness, and occupational health and safety.

1. completeness of facilities and infrastructure

Data regarding the completeness of facilities and infrastructure obtained from a questionnaire on laboratory management, addressed to the head of the laboratory, were collected from the five high schools under study. The questionnaire sheet for the completeness of infrastructure and facilities contains 10 questions where the total or maximum score is 10 points. The data results of the completeness of biology laboratory infrastructure and facilities questionnaire in the five schools under study can be seen in Table 2.

Table 2. Data on Completeness of Infrastructure and Facilities

No.	School code	Total Score	Percentage (%)	Category
1	S1	5	50	Good enough
2	S2	5	50	Good enough
3	S3	7	70	Good
4	S4	6	60	Good enough
5	S5	4	40	Less good
	Total		270	
	Average		54%	Good enough

In addition to data on the completeness of facilities and infrastructure obtained through questionnaires, data on the completeness of facilities and infrastructure were also obtained through direct observation in the laboratory. The results of these observations are presented in table 3.

Table 3. Observation Results of Completeness of Laboratory Facilities

No.	School code	Total score	Percentage (%)	Category
1.	S1	41	29	Incomplete
2.	S2	67	48	Complete enough
3.	S3	97	69	Complete
4.	S4	45	32	Incomplete
5.	S5	41	29	Incomplete
	Total		207	
	Average		41	Complete enough

2. Laboratory Conditions

The data of the laboratory head questionnaire relating to the environmental conditions of the biology laboratory includes five questions, with a maximum score of 5 points. The results of the data from the questionnaire regarding the completeness of the infrastructure and facilities of the biology laboratory in the five schools studied can be seen in Table 4.

Table 4. Environmental Condition Data

No.	School code	Total Score	Percentage (%)	Category
1	S1	5	100	Very good
2	S2	5	100	Very good
3	S3	5	100	Very good
4	S4	5	100	Very good
5	S5	5	100	Very good
	Total		**500**	
	Average		**100**	**Very good**

In addition to the data from the questionnaire, data regarding the condition of the laboratory environment was also obtained through direct observation in the laboratory. The results of these observations are presented in Table 5.

Table 5. Observation Results of Laboratory Environmental Conditions

No.	School code that was researched	Score total	Percentage (%)	Category
1.	S1	4	67	Complete
2.	S2	4	67	Complete
3.	S3	5	83	Very complete
4.	S4	4	67	Complete
5.	S5	5	83	Very complete
	Total		**367**	
	Average		**73**	**Complete**

3. Administrative Completeness

Data collection of the results of the laboratory head questionnaire refers to the completeness of the Biology Laboratory Administration. This questionnaire of the completeness of the Biology Laboratory Administration of SMA in Lahat Regency contains 25 questions where the total or maximum score is 25 points. The results of data analysis of the completeness of the high school biology laboratory administration questionnaire in Lahat Regency can be seen in Table 6.

Table 6. Administrative Completeness Data

No.	School code	Total Score	Percentage (%)	Category
1	S1	21	84	Very good
2	S2	25	100	Very good
3	S3	20	80	Good
4	S4	25	100	Very good
5	S5	12	48	Good enough
	Total		**412**	
	Average		**82%**	**Very good**

In addition to the data from the questionnaire, data regarding the completeness of the Biology Laboratory Administration was also obtained through direct observation in the laboratory. The results of these observations are presented in table 7.

Table 7. Observation Results of Completeness of Biology Laboratory Administration

No.	School code that was researched	Total score	Percentage (%)	Category
1.	S1	2	20	Incomplete
2.	S2	1	10	Incomplete
3.	S3	6	60	Complete enough
4.	S4	3	30	Incomplete
5.	S5	2	20	Incomplete
	Total		140	
	Average		28	Incomplete

3. occupational health and safety in the laboratory

Data collection on the results of the laboratory head questionnaire refers to occupational health and safety in the biology laboratory. This Laboratory Environmental Condition questionnaire sheet contains 8 questions where the total or maximum score is 8 points. The results of data analysis of the results of the questionnaire of occupational health and safety in biology laboratories in the five schools studied can be seen in Table 8.

Table 8. Occupational health and safety data in the laboratory

No.	School Code	Total Score	Percentage (%)	Category
1	S1	8	100	Very good
2	S2	8	100	Very good
3	S3	8	100	Very good
4	S4	8	100	Very good
5	S5	6	75	Good
	Total		475	
	Average		95%	Very good

In addition to the data from the questionnaire, data on occupational health and safety in the laboratory was also obtained through direct observation in the laboratory. The results of these observations are presented in Table 9.

Table 9. Observation Results of Laboratory Health and Safety

No.	School code that was researched	Total score	Percentage (%)	Category
1.	S1	4	40	Incomplete
2.	S2	4	40	Incomplete
3.	S3	8	80	Complete
4.	S4	4	40	Incomplete
5.	S5	5	50	Complete enough
	Total		250	
	Average		50	Complete enough

Discussion

Based on the results of questionnaires and observations of laboratory management components, it can be seen that the completeness of facilities and infrastructure components is quite good and quite complete, laboratory conditions are categorised as very good and complete, administrative completeness is good but less complete and the category of occupational health and safety in the laboratory is very good and complete.

1. Completeness of Facilities and Infrastructure

Based on the results of the questionnaire, it can be seen that all schools studied already have a storage room for practicum tools and materials. However, the three schools studied, namely S2, S4, and S5, did not have a preparation room where when going to carry out practicum preparation was carried out at the demonstration table. Then for the administration room in two schools namely S2 and S5 do not have an administration room. In addition, the tools and materials used in five schools still do not meet the standards set by the government in accordance with the provisions in Permendikbud No. 2018. In the five biology laboratories studied, the use of practical equipment and materials was still inadequate, mainly due to the lack of beakers, many of which were damaged and broken. In addition, a number of existing chemicals could no longer be used because of their damaged condition. In addition, some of the materials mentioned in Permendikbud No. 8/2018 are also not available and do not meet the standards, such as Sulfuric Acid, HCL, Acetokarmin, Eosin, Ethanol, Glucose, Universal indicator, Iodine, KOH, $MnSO_4$, NaOH, filter paper, and Vaseline. In addition, observation data shows that the entire biology laboratory space has been used in accordance with its functional purpose. In the five schools studied, there is already a storage room for tools and materials. However, the cleanliness of the room is not maintained, because many cabinets and tools and materials are no longer suitable for use and dusty, but have not been disposed of or cleaned. The preparation room was only owned by one school and for the other four schools, the preparation was done at the demonstration table. The two schools studied did not have an administration room so that the storage of laboratory administration in the school was placed in the teacher's room while the other three schools already had an administration room. According to Anggarani, et al (2024); Hidayati & Fauziyah (2023) that the readiness of the biology laboratory includes the completeness of laboratory facilities and infrastructure in supporting Biology Laboratory Readiness can support Practical Work and student learning activities.

2. Laboratory Conditions

Based on the results of the questionnaire, it shows that the school fulfils all of them from starting to pay attention and checking the lighting, checking electrical sockets, paying attention to the water installations available in the water tap whether it is functioning or not, arranging the comfort of the work table and the students' work area, and giving reminders to students about the use of water and electricity. these five things have been done by all laboratory heads in the five schools studied and this is in accordance with the theory in the Biological Laboratory Management book (Sani, 2018). Based on the observation of the environmental conditions of the five schools, the results show that the highest percentage score is S3 and

S5 with a percentage of 83% which is classified as very complete while S1, S2, S4 with a percentage of 67% is classified as complete. The observation results show that there is one biology laboratory that is not equipped with ventilation, which does not meet the standards. According to Sani (2018), school laboratory rooms require adequate ventilation, both in the form of natural and artificial ventilation such as fans or air conditioners. Based on observations, the five laboratories for water supply did not meet the standards because there were laboratories that had 6 sinks but the water taps were not alive and there were water taps that were alive but the standards did not meet there was only one sink in the laboratory.

3. Completeness of Biology Laboratory Administration

According to the questionnaire data, there are two laboratories that do not have a technical guidebook for laboratory management administration. This technical guidebook is very important to ensure that laboratory management is carried out properly. Standard Operating Procedures (SOPs) for the use of lab equipment and materials are crucial. Without SOPs, the use of tools and materials can pose a risk to students. Therefore, the head of the laboratory needs to develop a clear SOP so that learners understand the right way to use tools and materials during practicum, and can be more careful during these activities.Based on the results of the questionnaire, it was found that one laboratory head, namely in S5, had not developed a laboratory SOP. Administrative records, such as inventorying, purchasing, receiving, and issuing practical tools and materials, are very important for the head of the laboratory. With neat recording and organisation in a book, all tools and materials in the laboratory can be managed more easily for administrative needs. Based on the results of the questionnaire, one laboratory head, namely in S5, has not compiled the administration book. As a result, the number and types of tools and materials received in the laboratory are not recorded and there is no record of the release of damaged or broken tools and materials. The book for borrowing practical tools and materials is very important for students, because without recording, there will be a risk of loss or damage to borrowed tools and materials. Compiling a practicum implementation list book is very important to avoid schedule clashes and ensure that laboratory assistants can help with practicum preparation according to a predetermined time. In addition, based on the observation of the completeness of the administration of the five schools studied, it was found that the highest percentage score was S3 with a percentage of 60% which was classified as quite complete while the lowest percentage score was S2 with a percentage of 10% which was classified as incomplete. Based on observations in five laboratories, there are three laboratories whose administration is classified as incomplete, namely S1, S2, and S5. The three laboratories do not have an inventory list of tools, a list of tool damage, a list of expired materials, a tool loan card, a list of materials, a list of material usage and a list of tool and material requirements based on budget allocations. This does not exist because laboratory managers are lazy to compile administration in the laboratory, while S3 is classified as quite complete and S4 is classified as incomplete. This is also expressed in the research of Novia & Muhimmatin (2024) that the carrying capacity of laboratories including administrative completeness needs to be improved to support biology learning activities, especially in practicum activities.

4. Occupational Health and Safety

From the questionnaire results, it was found that one laboratory head in S5 did not have a structured procedure for the use of hazardous tools and materials. It is important for learners to understand how to use the tools and materials used in lab work, as their ignorance can cause hazards during lab work. Occupational safety, including the use of personal protective equipment when doing lab work, is very important. The results of the questionnaire show that all laboratories are equipped with laboratory coats, but there are four laboratories that do not have safety glasses, only two laboratories are equipped with gloves, and only one laboratory provides masks. The use of personal protective equipment by students during lab work is very important, because it can reduce the risk of accidents that can harm them. In addition, based on the observation of the five laboratories, all of them have laboratory rules. Then for instructions on the use of tools and practicum guidelines, there are only two laboratories that exist. For personal protective equipment such as laboratory coats, all laboratories already have them. Gloves and protective glasses are only owned by one laboratory while the other four laboratories do not exist. First aid boxes from five laboratories only three laboratories have first aid boxes available while the other two laboratories have first aid boxes but there are no contents. The availability of fire extinguishers from five laboratories there are only four laboratories available fire extinguishers and the availability of emergency contacts overall five laboratories are not available emergency numbers. Aspects of occupational health and safety in the laboratory need to be improved. Every individual involved in the laboratory needs to have awareness and commitment to

manage, maintain, and ensure work safety. Although not all risks can be avoided when handling laboratory materials, safety and security can be improved through informed risk assessment and proper management (Trasmini, et al., 2021).

Conclusion

The management of high school biology laboratories in Lahat Regency shows excellence in completeness of facilities and infrastructure. This can be seen from the utilisation of storage space for tools and materials, but still faces obstacles related to the completeness of facilities and infrastructure, such as inadequate preparation and administration space, and tools and materials that do not meet national standards. The condition of the laboratory is generally quite good, with lighting, electrical installations, and work comfort being considered, although ventilation and water availability are still issues that need to be addressed. Laboratory administration is still not well organised, due to deficiencies in documentation such as SOPs and inventory lists, which has an impact on the management of tools and materials. In the aspect of occupational health and safety, although laboratory rules and suits are available, the availability of personal protective equipment, complete first aid kits, and other safety facilities is still very limited, which indicates that safety aspects have not been a top priority in laboratory management.

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