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## **The Quality of Infrastructure Facilities and the Readiness of Biology Laboratories to Support Learning in High School**

**Mei Renni Sholikhah, Lina Agustina\***

Biology Education Department, Faculty of Teacher Training and Education, University of Muhammadiyah Surakarta. Jl. A. Yani Tromol Pos I, Pabelan, Kartasura, Surakarta 57162, Central Java, Indonesia

\*Corresponding Author. E-mail address: la263@ums.ac.id

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### **ABSTRACT**

**KEYWORDS:**

*Readiness  
Quality of infrastructure  
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Biology learning is the mastery of collecting knowledge information in concepts, principles, and facts, as well as learning and comprehending how the process of acquiring knowledge is achieved directly through the practicum. Physical and social skills can be developed through the use of practicum activities as a learning supplement. The implementation of practicum activities must be supported by a high-quality laboratory infrastructure. The laboratory equipment and infrastructure of Cal must comply with the laboratory requirements outlined in Permendiknas Number 24 of 2007. The research aimed to determine the quality of infrastructure facilities and the readiness of biology laboratories to support learning at SMA Negeri 1 Cawas. This research is qualitative descriptive research through observation, interviews and documentation. The results showed that the quality of biological laboratory infrastructure based on Permendiknas Number 24 of 2007 was included in the perfect category with an average percentage of 95%. Meanwhile, laboratory readiness obtained an average readiness percentage value of 92%, including in the ready category, so the biology laboratory in this school is ready to be used to support learning.

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## **1. INTRODUCTION**

In a learning environment, learning is the process of interaction between participants, instructors and learning resources. Education give learning so that the process of obtaining knowledge can occur (Suardi, 2018). Biology is a discipline of study that examines the variety and interdependence of all living organisms on Earth. Thus, biology is among the sciences that contribute considerably to the growth of science (Susilawati & Bakhtiar, 2018). As a field of study, biology stands out due to the investigation of all living things, the theme of problems affecting biological objects that arise in nature, and the use of scientific methods to resolve concerns. Biology education is impacted by the characteristics of biology as a science (Trianto, 2010).

Learning biology involves not only mastery of the collection of knowledge information in the form of concepts, principles, and facts, but also learning and comprehension of how knowledge is acquired. Biology education should stress direct experiential learning in order to give students with meaningful learning in the cognitive, psychomotor, and affective domains. Biology education teaches and comprehends how knowledge is acquired through practical actions (Daba et al., 2017). Practical activities in biology learning are carried out to arouse student learning motivation, develop basic skills in conducting experiments, and as a promoter of the delivery of teaching materials, hence biology education and practicum are linked (Neji et al., 2014). This demonstrates the importance of laboratories in aiding biology teaching and accomplishing educational goals (Kalsum et al., 2018). Practical activities can take place well when the availability of the means and facilities of the biological laboratory in supporting the practice is available in a good condition

and a sufficient amount, it must comply with the Permendiknas Number 24 of 2007 standard on the medium and facility of high school or madrasah aliyah (SMA or MA), so that the laboratory is one of the most important facilities in support of biological practice (Poedjiadi, 2007).

A laboratory is a location where observations, scientific research, experiments, and other scientific endeavors are conducted. The laboratory is one of the most important components for supporting biology education in schools, needing confirmation between theory and reality (Daud & Pratiwi, 2017). Through problem solving, educators can also strengthen their critical thinking abilities in a laboratory. Without a school laboratory, it will be difficult to develop the competence and quality standards of educators therefore, it is necessary to have a laboratory with quality infrastructure in accordance with Permendiknas Number 24 of 2007 that is managed professionally, as laboratory infrastructure is one of the most essential laboratory resources and should not be neglected (Gusnani et al., 2019).

To facilitate practicum activities, students must be laboratory ready in order to cultivate scientific attitudes and promote learning. Aspects of laboratory preparedness, such as laboratory room design, laboratory administration, storage of laboratory material instruments, and well-managed laboratory management, will give students with a genuine laboratory experience (Russel et al., 2018). The establishment of standardized biology laboratories will facilitate the optimal operation of the laboratory-dependent learning process and the attainment of educational objectives (Rahmiyati, 2018).

In support of the school's vision and goal, SMA Negeri 1 Cawas develops numerous facilities that can be utilized by all school components. One of the school's facilities is the biology laboratory. Based on observations and interviews, it has been determined that the biology laboratory at this school has been utilized actively to enhance learning. To yet, there has been no research on the quality of infrastructural facilities and the readiness of biological laboratories. Even though SMA Negeri 1 Cawas is one of the state schools and holds the title of Adiwiyata for his many accomplishments, the research aims to provide information on the description of the quality of infrastructure facilities and the readiness of laboratories biology to support learning, so that it can be used as evaluation material for all parties involved.

## **2. RESEARCH METHODS**

### *2.1. Types of Research*

This qualitative descriptive research aims to provide an overview of the quality of infrastructure facilities and the readiness of biological laboratories to support learning at SMA Negeri 1 Cawas.

### *2.2. Place and Time of Research*

This research was carried out in the biology laboratory of SMA Negeri 1 Cawas, which is based on Jl. Tembus Cawas-Pedan, Tugu, Cawas, Klaten, Central Java 57463. The study will be conducted from February 2023 to May 2023 and calculated from submitting titles to reporting research results.

### *2.3 Data and data sources*

Data is collected in the form of laboratory rooms, laboratory furniture, experimental tools and materials, educational media, consumables, and other equipment for the aspect of biological

laboratory infrastructure quality, while data is collected in the form of laboratory room design, laboratory administration, laboratory management, storage of tools and materials, and completeness of equipment for the aspect of biological laboratory readiness. Laboratory management instructors and laboratory spaces are the sources of the data for both elements.

## 2.4 Data Collection Techniques

### 2.4.1 Observation

Observation in this study aims to determine the quality of facilities and infrastructure and the readiness of biological laboratories. This is done using non-participatory techniques. Namely, researchers are not involved in the learning process but only as observers. Hence, researchers make direct observations to see and observe laboratory rooms, furniture, experimental tools and materials, educational media, consumables, teaching aids and other equipment based on the standards listed in Permendiknas Number 24 of 2007.

### 2.4.2 Interview

To gather information about the standard of infrastructure facilities and the readiness of biological laboratories, this study interviewed laboratory management teachers. To determine laboratory readiness, interviews are conducted in closed settings with a restricted number of response options such as always, frequently, never, and sometimes and in open settings with unlimited response options.

### 2.4.3 Documentation

Documentation is done in biological laboratories to provide tangible proof of observations. According to Permendiknas Number 24 of 2007, the information was obtained in the form of images or photographs related to laboratories.

## 2.5 Research Procedure

The process in this study begins with the stage of preparation, which takes the form of problem formulation, draft question preparation, instrument validation submission, and practice of research licensing letter. The second stage is implementation, which entails doing research on the infrastructure facilities' quality and biological laboratories readiness to assist learning while using predetermined data collection methods and documenting all study findings. The last stage is when data processing, inference, and compilation are completed.

## 2.6 Data Analysis Techniques

Data obtained from observations of the quality of infrastructure facilities and closed interviews of biological laboratory readiness are then analyzed. There is an observation of the quality of infrastructure facilities obtained compared with the standards written in Permendiknas Number 24 of 2007. The results of the study can be calculated by the percentage formula (Agustina & Ningsih, 2017):

$$P = \frac{n}{N} \times 100\%$$

Information:

P: percentage

n: the number of scores obtained

N: maximum number of scores

The percentage results are interpreted based on their respective criteria:

a. Quality of laboratory infrastructure

- 81% – 100% : Excellent
  - 61% – 80% : Good
  - 41% – 60% : Good enough
  - 21% – 40% : Not Good
  - 0% – 20% : Very Not Good
- (Agustina et al., 2019)

b. Laboratory Readiness

- 76% – 100% : Ready
  - 56% – 75% : Simply Ready
  - 41% – 55% : Less Prepared
  - ≤ 40% : Not Ready
- (Sugiyono, 2013)

### 3. RESULTS AND DISCUSSION

#### 3.1. *Quality of Laboratory Facilities and Infrastructure In Supporting Learning*

The laboratory has a crucial role in learning biology in schools, especially at the high school level, because the activities there can support the achievement of competencies and learning objectives related to psychomotor and actual experience in the field. Facilities and infrastructure in educational institutions are supporting factors for teaching and learning in schools, and one of them is the laboratory. Standardizing the caliber of optimum infrastructure and facilities for biological laboratories alludes to Permendiknas Number 24 of 2007 (Jannah & Sontani, 2018).

The observation results regarding the quality of biological laboratory facilities and infrastructure refer to the Permendiknas Number 24 of 2007 standards. This standard is used as a reference for minimum research standards regarding the quality of biological laboratory facilities and infrastructure at SMA Negeri 1 Cawas. According to standardizing natural laboratory infrastructure must meet predetermined criteria, including laboratory space, furniture, teaching aids, experimental tools and materials, educational media, consumables, and other equipment in the laboratory. Data on the quality of biological laboratory infrastructure are presented in Table 1.

**Table 1.** Quality of Biology Laboratory Infrastructure Facilities SMA Negeri 1 Cawas

No	Observed aspects	Percentage	Category
1.	Laboratory Room	100%	Excellent
2.	Furniture	100%	Excellent
3.	Props	96%	Excellent
4.	Experimental Tools and Materials	97,2%	Excellent
5.	Educational Media	100 %	Excellent
6.	Consumables	92,3 %	Excellent
7.	Other Equipment	80%	Good
	<b>Average</b>	95%	Excellent

Based on Table 1, it is known that the quality of biological laboratory infrastructure in supporting learning in the school shows an average score of 95%, which is included in the category of high school even though it has not 100% satisfied the requirements of Permendiknas Number 24 of 2007 while also supporting practical activities to aid in the school's biology curriculum. The indicators given below show that each aspect noticed has a distinct percentage of the value:

### 3.1.1. Laboratory Room

The laboratory room is used to carry out practicum or research activities supported by complete facilities. According to Permendiknas Number 24 of 2007, a good laboratory room can accommodate at least one study group with a minimum ratio of 2.4 m<sup>2</sup>/student for a study group of fewer than 20 students, a minimum laboratory area of 48 m<sup>2</sup> including storage and preparation space of 18 m<sup>2</sup>, and the minimum width of the laboratory is 5 m, with the laboratory room having adequate lighting facilities for reading books and observing experimental objects. The laboratory room must also be clean water available. The observations on the laboratory room indicator obtained a percentage value of 100%, indicating that the laboratory room aspect is included in the perfect category and meets the standards.

The biology laboratory room in this school has met the minimum ratio of space, with a room area of 100 m<sup>2</sup> and a biology laboratory width of 9 m, with a group of 36 students. The laboratory room is spacious, so students are free when doing a practicum. The laboratory room is neat, clean, comfortable and organized. The laboratory room is divided into two parts: the practicum and separate storage rooms for tools and materials. The storage room is in front of the practicum room with an area of 20 m<sup>2</sup>. Research Kurniawan (2021), the separation of practice rooms from tool and material rooms is intended so that students and teachers have no difficulty finding tools and materials. Besides, it aims to prevent practicum tools and materials from being damaged due to accidents in practicum activities in the laboratory.



**Figure 1.** Biology laboratory room at SMA Negeri 1 Cawas

This school's biology lab provides good lighting, which makes it simpler for students to read textbooks and carefully inspect experimental objects. The laboratory has a fan inside and numerous vents at the top of each window, which improves air circulation and adds to the comfort of the pupils. Ample clean water is also available in the lab space from sinks located on the west and east sides of the student desks. Research Maharani & Sasi (2019), the environmental conditions of biological laboratories also need to be considered, among others, with adequate air circulation and ventilation systems, adequate water needs, and room temperatures that are maintained constant and safe from interference.

### 3.1.2. Furniture

Furniture is equipment items that function to support the course of practicum. According to Permendiknas Number 24 of 2007, laboratory furniture facilities include chairs, student tables, demonstration tables, preparation tables, tool cabinets, material cabinets, and sinks. Based on observations about laboratory furniture at SMA Negeri 1, Cawas obtained a percentage value of 100%, included in the perfect category, where aspects of furniture in the biological laboratory have met the minimum standards.

The biological laboratory equipment consists of nine student desks that are large enough to accommodate groups of students, one presentation table, and 50 seats, divided into 46 student chairs and four teacher chairs that are sturdy, stable, safe, and easy to move. There are two long preparation tables so that they can add all the necessary tools and materials to be used. The table is in the front, the table is extended to accommodate the materials tools to be used, spacious, strong, suitable for use, and adequate height, allowing students to observe the experiment demonstrated. Next to the wall and perpendicular to the sink is the prep table. Tool cabinets and materials that are large enough and plentiful enough to hold all tools are not readily corroded, closed, and lockable. For practicum activities, six sinks have smooth, clear water faucets. According to research Rahman (2017), laboratory water installations are utilized to wash hands after practicum if they become unclean or are exposed to dangerous substances.

### 3.1.3. Props

Teaching aids are learning aids and objects used to demonstrate learning materials. Based on the observation of teaching aids in the biology laboratory of SMA Negeri 1, Cawas obtained a percentage of 96%, indicating that the teaching aids facilities of the biology laboratory in this school are included in the perfect category even though they have not 100% met the standards of the Ministry of National Education Number 24 of 2007. The teaching aids facilities listed by Permendiknas Number 24 of 2007 consist of 25 types of tools namely: human skeleton models, human body models, various preparations, chromosome images, DNA images, RNA images, Mendelian inheritance images, plant examples drawings from multiple divisions, animal examples drawings from different species, drawings or models of various systems in animals and humans, and draw the evolution tree. Of the 25 types of props observed, 24 kinds of equipment follow the standard, namely having good conditions, suitable for use, and ratios and descriptions that follow the norm. The thing that causes teaching aids not to meet 100% of the standards of the is that there is no image of an evolutionary tree, so it is necessary to strive for a picture of an evolutionary tree that can provide more insight to students about evolutionary material more efficiently.

But since the teaching materials in the school's biology lab are thorough, they are helpful for the learning that takes place there. Students will be better able to understand the material given that there is complete educational equipment available and a variety of tools that adhere to the requirements. This is supported by Trisianawati (2020), that the state of complete practicum tools and materials will make teachers maximize the use of laboratories in supporting the implementation of learning and students will be easier to understand and learn the principles and Natural Sciences, so that they can be used in everyday life.

### 3.1.4. Experimental Tools and Materials

Before practicum, tools and materials are necessary since research or training cannot be conducted without tools and experimental materials. The comprehensiveness of tools and materials

facilitates the success and simplicity of practical activities, hence facilitating the accomplishment of educational objectives. This study observed 36 types of experimental instruments and materials, including microscopes, thermometers, balance sheets, test tubes, measuring pipettes, watch glasses, funnels, Petri dishes, universal clamps, tricycles, measuring cups, stopwatches, and other material tools that support practicum operations.

Based on the observation results of experimental tools and materials obtained a percentage value of 97,2%, which indicates that the facilities of biological laboratory practical tools and materials at SMA Negeri 1 Cawas are included in the perfect category even though they have not 100% met the standards of the Permendiknas Number 24 of 2007, but have been able to support the process of implementing biology practicum activities in supporting learning. The availability of useful tools and materials is what prevents experimental tools and materials from meeting norms. There are still some ratios, though, that do not adhere to the standards. For instance, there aren't enough long and short stative rod devices; the norm calls for six sets each lab. In order to make it simpler for students to use the instrument, it is important to try to add a static rod device to satisfy a predetermined ratio. Research Hayati (2020), the availability of experimental tools and materials in a laboratory is the basis for achieving good practices.

#### *3.1.5. Educational Media*

Educational media can deliver learning materials to attract students' attention, interests, thoughts and feelings in learning activities to achieve specific learning goals (Sumiharsono & Hasanah, 2017). Educational media contained in the biology laboratory is a whiteboard with a standard of 1 piece per laboratory with a minimum size of 90 cm x 200 cm placed in a position that allows all students to see it. The whiteboard is an essential object in the teaching and learning process, one of whose functions is as a medium for writing learning materials.

Based on the results of observations of educational media in the biology laboratory, SMA Negeri 1 Cawas obtained a percentage of 100% which indicates that the educational media facilities in the biology laboratory are included in the perfect category and have met the standards of the Permendiknas Number 24 of 2007. The blackboard contained in the biology laboratory at this school follows the minimum requirements of the biology laboratory, which is one piece measuring 120 cm x 200 cm with good conditions and suitable for use. The whiteboard is placed at the front so students can see clearly. There are other educational media in the biology laboratory room, namely LCD projectors teachers use to explain material when using laptop media. Research Mastika (2014), which shows that the whiteboard facilities in the Science/Biology laboratory room at SMA Negeri Kota Denpasar obtained 100% data, indicating that the furniture facilities at SMA Negeri Kota Denpasar mean that they meet the minimum standards listed in Permendiknas Number 24 of 2007.

#### *3.1.6. Consumables*

Consumables are materials that are used and run out quickly or are not durable. The consumables listed in Permendiknas Number 24 of 2007 are Sulfuric Acid, HCL, Acetokarmin, Eosin, Ethanol, Glucose, Universal Indicators, Iodine, KOH, MnSO<sub>4</sub>, NaOH, Vaseline, and filter paper. Based on the observation of consumables at the biology moratorium of SMA Negeri 1, Cawas obtained a percentage value of 92,3%, indicating that the consumables of the biology laboratory at this school are included in the perfect category. However, they have not 100% met



the standards of the Permendiknas Number 24 of 2007 but have been able to support the process of implementing biology practicum activities so that they can support learning in the laboratory.

According to the findings of observation sheets used in the biology lab at SMA Negeri 1 Cawas, the reason why experimental instruments and materials don't meet criteria is because consumables are still available but don't have the right ratio of them. The balance established by Permendiknas Number 24 of 2007 is four rolls/lab, however these consumables, universal indicators, are only offered in four rollers/lab. The supplies used in the biology lab at SMA Negeri 1 Cawas are all in good shape and kept in durable glass cabinets made of wood. As a result, they do not rust easily, and all consumables are excellent for usage because both solid and liquid materials have a long shelf life. The government has lately provided this school with funding for a substantial quantity of consumables that meet the requirements of Permendiknas Number 24 for the of 2007.

### *3.1.7. Other Equipment*

Other equipment is additional equipment to support practicum learning in biology laboratories. Biological laboratory facilities in the aspect of other equipment consisting of electrical sockets, fire extinguishers, P3K, trash cans, and wall clocks at SMA Negeri 1 Cawas obtained a percentage of 80% which indicates that other equipment facilities in the biology laboratory at this school are included in the excellent category even though they have not 100% met the standards set in Permendiknas Nounber 24 of 2007.

According to the findings of observation sheets in this school's biology lab, the availability of alternative equipment is what prevents experimental tools and materials from meeting criteria. However, several still fall short of the ratios and description requirements for the measurements. Another piece of equipment is an electrical socket; there are only four electrical outlets available for the nine desks that students are assigned, and the electrical socket is faulty and dangerous to use. As a result, given that the electric socket ratio is one of the laboratory's major supporters, improvement and expansion are required. According to research Adilah (2021), water facilities are used to wash hands if filthy or exposed to toxic chemicals, and to wash dirty practicum equipment after usage. Electrical installation facilities are necessary for voltage sources in carrying out practicums that require electricity. Additionally, pure water can be used in laboratories. Because mishaps during practicum can happen at any time, biological laboratories must have P3K equipment and fire extinguishers available to cope with incidents in the lab.

### *3.2. Readiness of Biology Laboratory in Supporting Learning*

Laboratory administration, facility completion, equipment and material storage, and room design are all important factors. Planning, organizing, structuring, maintaining, and overseeing are some of the components of laboratory management (Candra & Hidayati, 2020). With adequate laboratory readiness, it will also affect the biology learning process that requires a laboratory.

Based on research that has been conducted on the readiness of biology laboratories in supporting learning at SMA Negeri 1 Cawas from the results of closed interviews with laboratory management teachers and observations of the completeness of laboratory material equipment facilities referring to the standards of the Permendiknas Number 24 of 2007. Each question item has a short answer, such as never, sometimes, often and consistently, so a short but definite answer is obtained. The four answers have their value weight. Data on the readiness of biological laboratories are presented in Table 2.

**Table 2.** Readiness of Biology Laboratory of SMA Negeri 1 Cawas



No	Indicators	Percentage	Category
1.	Laboratory Room Design	85%	Ready
2.	Laboratory Administration	95%	Ready
3.	Laboratory Management	88%	Ready
4.	Storage of Tools and Materials	95%	Ready
5.	Completeness of tools and materials	96,5%	Ready
	<b>Average</b>	92%	Ready

Based on Table 2, it can be seen that the readiness of the biology laboratory to support learning in this school shows an average score of 92%, which is included in the ready category even though it has not reached a percentage of 100%. Where each aspect observed has a different ratio of value, it can be seen from the indicators described as follows:

### 3.2.1. *Laboratory Room Design*

From the results of closed interviews, the laboratory room design obtained a readiness percentage value of 85%, indicating that the creation of the biology laboratory room at SMA Negeri 1 Cawas was included in the ready category. However, it had not yet reached the percentage of 100% value. The design of the biology laboratory room at this school was prepared to be used in supporting practicum activities. Questions regarding the design of laboratory rooms, made referring to the standards of the Permendiknas Number 24 of 2007, such as the area of laboratory space, laboratory layout, setting the distance between experimental and storage rooms, specifying the number of students to maintain student comfort during the practicum process, availability of water, and sufficient lighting. The interview results show that the biology laboratory in this school has been designed following standards, namely the distance between the laboratory and other buildings is about 4 m, with an area of 100 m to allow 36 students to enter, the availability of water is adequate as evidenced by the presence of 6 sinks in the room complete with water faucets and three pieces outdoors in front before entered the laboratory.

The biology laboratory is equipped with a good light source, making it easier for students to conduct experiments or activities because there is no lack of lighting. This is in line with Research Mastika (2014), that the distance between the laboratory and other buildings is at least equal to the height of the nearest building  $\pm$  3 meters so that the room can be optimal in getting direct lighting from sunlight and not located in the wind direction, to avoid air pollution. Almost all criteria referenced in the biological laboratory design readiness assessment are met. Only a few aspects have not been met by some high schools, namely: lack of the number of electric sockets, because many electric sockets have broken and do not function, so it is necessary to improve and add sockets to support the learning process better.

### 3.2.2. *Laboratory Administration*

The readiness of laboratory administration is indicated by criteria stating that in the laboratory, several aspects need to be administrated, including Administration of biological laboratory rooms, Administration of biological laboratory facilities, Administration of experimental tools and materials, Administration of personnel and Administration of activities laboratory. From the results of closed interviews regarding laboratory administration, the readiness value of 95% indicates that the biology laboratory administration at SMA Negeri 1 Cawas is

included in the ready category. Although it has not yet reached the percentage of 100% marks, the laboratory administration carried out by the manager is classified as ready where the school Always make an inventory of tools and materials, both new and old, makes a list of material equipment needs every semester, record all material tools that have been damaged both after and before practicum begins, make inventory data on the receipt of material tools both from schools and the government and do all inventories associated with other biological laboratories. Everything related to Administration is neatly arranged in soft files and complex files booked.

It will be simpler for the school to know the state of the lab and make future changes with good administration. Research Rahmiyati (2018), effective administration helps with planning for the purchase of equipment or materials, monitoring the effectiveness of budget use, facilitating the implementation of activities, presenting reports objectively, facilitating supervision, and protecting laboratory wealth, which is one of the costly investments made by the government in the education sector.

### *3.2.3. Laboratory Management*

Laboratory management, or laboratory management, is an activity to plan, maintain, secure and administer to develop the laboratory efficiently and effectively to achieve a goal (Astuti, 2017). From the results of closed interviews regarding laboratory management, a readiness percentage value of 88% was obtained, indicating that the management of the biology laboratory at SMA Negeri 1 Cawas was included in the ready category. However, it had not yet reached the percentage of 100% marks. The management of the biology laboratory at the school was prepared to support learning.

Almost all criteria referenced in the readiness assessment of the management aspect of biological laboratories are met. Only some elements have not been met, such as periodic chemical maintenance following the way and place of storage. That is because the laboratory staff is minimal. In contrast, the biology laboratory in this school only amounts to 1 person who doubles as a subject teacher, so the time to carry out maintenance is irregular.

### *3.2.4. Storage of Tools and Materials*

Storage of tools and materials consists of giving codes, names and specifications on practicum tools and materials, storing hazardous materials separately from other materials, storing tools and practicum materials based on function and use, storage of practicum tools is carried out in the form of sets, avoiding tools and materials from harmful environmental influences. The results of closed interviews regarding the readiness of storage of tools and materials obtained a readiness percentage value of 95% which indicates that the storage of biological laboratory tools and materials at SMA Negeri 1 Cawas is included in the ready category. However, it has not reached the percentage of 100% value. The storage of tools and materials carried out follows the standards in this study.

Storage of tools and materials is placed in cabinets whose doors can be closed tightly but are still easy to reach to facilitate the retrieval of glass tools are also placed in the same cabinet, making it easier to supervise. Equipment that is three dimensional such as a torso, is stored in a glass cupboard and separated from other tools. Therefore, this school's laboratory equipment and materials storage aspect is ready to support learning. Research Maharani & Sasi (2019), tools that are often used are usually placed in separate cabinets with instruments made of glass grouped or

stored in one cupboard. In addition, there is a cabinet to store tools made of glass and tools used to store microscopes. The chemicals used for practicum are also stored in a separate cupboard to make it easier to prepare for practicum activities. Likewise, three dimensional props such as the human torso and its constituent organs are stored in a joint cabinet.

### *3.2.5. Completeness of Tools and Materials*

The completeness of physical laboratory facilities and infrastructure is essential in smoothly implementing practicum activities following learning objectives. The available budget and laboratory arrangements support factors that support the entirety of practicum material equipment in the laboratory. From the observation of the completeness of experimental equipment and material facilities, obtaining a readiness percentage value of 96,5% indicates that the entirety of equipment and material facilities in the biology laboratory of SMA Negeri 1 Cawas is included in the ready category, even though it has not met 100% of the standards of the Permendiknas Number 24 of 2007 but has been able to support the process of implementing biology practicum activities so that it can support learning in this school. All equipment and material facilities are in adequate condition and suitable for use. This is because all material tools are cared for by a laboratory worker assisted by subject teachers.

The completeness of equipment and material facilities observed in this study consisted of 82 observation items comprised of furniture, props, consumables, educational media, and other equipment to support the running of the practicum. Based on the results of observation sheets in biological laboratories, things that cause the completeness of laboratory equipment and material facilities are not 100% ready because there is some completeness of equipment and material facilities that do not exist or already exist but with ratios that are not following standards such as non-existent evolutionary tree images, lack of electric socket and lack of universal indicator ratios, so that there is still a need for improvement so that tools and materials are following standards which will also affect the learning process that is getting smoother, with that the purpose of learning will be easier to achieve. Research Agustina (2019), to create a good teaching and learning process and quality learning outcomes, the laboratory must have all the facilities and infrastructure needed and meet laboratory standards.

## **4. CONCLUSIONS**

The quality of the biological laboratory infrastructure at SMA Negeri 1 Cawas is included in the perfect competition with a percentage value of 95%. Although it has not met 100% of Permendiknas Number 24 of 2007 standards, the quality of biological laboratory infrastructure is following standards. It can support learning as for the level of laboratory readiness included in the ready laboratory with a percentage value of 92% so that it is prepared to help with biology learning in the school. The level of laboratory readiness studied includes laboratory design, laboratory administration, laboratory management, completeness of laboratory material equipment facilities and storage of laboratory material equipment.

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## 6. REFERENCES

- Adilah, M. (2021). Analisis Standarisasi Laboratorium Biologi SMA di Kota Pontianak. *Ilmiah Didaktika*, 21(2), 195–207.
- Agustina, P., & Ningsih, I. W. (2017). Observasi Pelaksanaan Praktikum Biologi di Kelas XI SMA Muhammadiyah 1 Surakarta T.A. 2015/2016 Ditinjau dari Standar Pelaksanaan Praktikum Biologi. *Bioeducation Journal*, 1(1), 34–43.
- Agustina, P., Saputra, A., Khotimah, E. K., Rohmahsari, D., & Sulistyanti, N. (2019). Evaluasi Pelaksanaan Praktikum Biologi di SMA Negeri di Klaten pada ditinjau dari Kualitas Laboratorium, Pengelolaan, dan Pelaksanaan Praktikum. *IBO-Pedagogi: Jurnal Pembelajaran Biologi*, 8(2), 105–110.
- Astuti, A. P. (2017). Jurnal Ilmiah Didaktika. *Jurnal Pendidikan Sains*, 5(1), 47–55.
- Candra, R., & Hidayati, D. (2020). Penerapan Praktikum dalam Meningkatkan Keterampilan Proses dan Kerja Peserta Didik di Laboratorium IPA. *Jurnal Kependidikan Dan Sosial Keagamaan*, 6(1), 26–37.
- Daba, T. M., Anbassa, B., Oda, B. K., & Degefa, I. (2016). Status of biology laboratory and practical activities in some selected secondary and preparatory schools of Borena zone , South Ethiopia. *International Conference on Teaching and Education (ICoTE)*, 11(17), 1709–1718.
- Daud, M. H., & Pratiwi, N. Y. (2017). Efektivitas Pengelolaan Labortarium IPA Pada SMP Negeri 1 Mambroko Kabupaten Sumba Tengah. *Pendidikan Ekonomi*, 2(1), 33–44.
- Gusnani, Y., Chiar, M., & Sukmawati. (2019). Pengelolaan Laboratorium IPA di Madrasah Tsanawiyah. *International Conference on Teaching and Education (ICoTE)*, 2(1), 135–141.
- Hayati, A. (2020). Evaluasi Standar Sarana Dan Prasarana Labpratorium IPA Di Sekolah Model SMA Negeri 7 Bengkulu Selatan. *Jurnal Manajer Indonesia*, 14(2), 70–83.
- Jannah, S. N., & Sontani, U. T. (2018). Sarana dan Prasarana Pembelajaran Sebagai Faktor Determinan Terhadap Motivasi Belajar Siswa. *Jurnal Pendidikan Manajemen Perkantoran*, 1(2), 63–70.
- Kalsum, U., Mustami, M. K., & Ismail, W. (2018). Pengembangan Modul Pembelajaran Biologi Materi Ekosistem Berbasis Pendekatan Contextual Teaching and Learning (CTL). *Jurnal Lentera Pendidikan*, 21(1), 97–109.
- Kurniawan, R. A. (2021). Analisis Standarisasi Sarana, Prasarana dan Tenaga Laboratorium IPA MTs Negeri 8 Jember. *Edulab: Majalah Ilmiah Laboratorium Pendidikan*, 6(1), 29–42.
- Maharani, R. I., & Sasi, F. A. (2019). Analisis Cek List Bahan Laboratorium di Laboratorium Biologi FMIPA UNNES. *Jurnal Teknologi Dan Manajemen Pengelolaan Laboratorium (Temapela)*, 2(1), 38–45.
- Mastika, N., Adnyana, P. B., & Setiawan, A. N. G. A. (2014). Analisis Standarisasi Laboratorium Biologi dalam Proses Pembelajaran di SMA Negeri Kota Denpasar. *Journal Program Pascasarjana Universitas Pendidikan Ganesha*, 4(1), 25–35.
- Neji, Amba, H., Ukwetang, O, J., Nja, & O, C. (2014). Evaluating the Adequacy of laboratory facilities on students' academic Performance in Secondary School in Calabar, Nigeria. *Journal of Research & Method in Education*, 4(3), 11–12.
- Permendiknas Number 24. (2007) Peraturan Menteri Pendidikan Nasional No 24 Tahun 2007 Tentang Standar Sarana dan Prasarana Untuk Sekolah Dasar/Madrasah Ibtidaiyah (SD/MI), Sekolah Menengah Pertama/Madrasah Tsanawiyah (SMP/MTS), dan Sekolah Menengah Atas/Madrasah Aliyah (SMA/MA).
- Poedjiadi, A. (2007). *Ilmu Dan Aplikasi Pendidikan Bagian 3 Pendidikan Disiplin Ilmu*. Grasindo.
- Rahman, M. S. (2017). Kajian Standarisasi Sarana Prasarana Laboratorium IPA Berdasarkan Permendiknas No. 24 Tahun 2007 di SMP N 4 Sumenep. *Jurnal Lensa (Lentera Sains)*, 7(1), 1–11.
- Rahmiyati. (2018). The Effectiveness of Laboratory Use in Madrasah Aliyah in Yogyakarta. *Jurnal Penelitian Dan Evaluasi Pembelajaran*, 1(2), 23–36.
- Suardi, M. (2018). *Belajar & Pembelajaran*. Depublish.
- Sugiyono. (2013). *Metode Penelitian Pendidikan*. Alfabeta.
- Sumiharsono, R., & Hasanah, H. (2017). *Media Pembelajaran*. Pustaka Abadi.
- Susilawati, & Bakhtiar, N. (2018). *Biologi Dasar Terintegrasi*. Kreasi Edukasi.
- Trianto. (2010). *Model Pembelajaran Terpadu Konsep, Strategi, Dan Implementasinya Dalam Kurikulum Tingkat Satuan Pendidikan (KTSP)*. Bumi Aksara.
- Trisianawati, E., Ita, & Fitria. (2020). Analisis Kelengkapan Alat dan Bahan Laboratorium IPA Sekolah di Kota Pontianak. *Jurnal Pendidikan Sains Dan Aplikasinya (JPSA)*, 3(2), 66–72.