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ANALYSIS OF THE SUITABILITY OF PHYSICS LABORATORY FACILITIES AND INFRASTRUCTURE

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ABSTRACT

This study aims to determine the level of suitability of physics laboratory facilities and infrastructure based on the Ministry of National Education Number 24 of 2007. The method in this research is descriptive quantitative using survey method. Data collection techniques using observation sheets have been adapted to Ministry of National Education Number 24 of 2007 and interviews. The subjects in this study were the facilities and infrastructure of the physics laboratory. The data analysis technique was carried out to describe the results of observations and interviews that had been carried out. Data analysis that will be carried out in the research is after the data is collected, the next step is to compare the existing physics laboratory facilities and infrastructure with Permendiknas Number 24 of 2007 whether they are suitability or not. The results of the research on the analysis of the suitability of the physics laboratory facilities and infrastructure at senio high school in west sumatera showed the level of conformity based on Ministry of National Education Number 24 of 2007 showed different results for each suggestion and infrastructure studied, namely in the learning facilities section of 100%, the basic measuring instrument of 84 .4%, practicum materials with a percentage of 92.4%, experimental tools by 69.2%, for educational media and other equipment and infrastructure with a percentage of 100%. Meanwhile, the results of the suitability of all existing facilities and infrastructure are 90% with the very appropriate category.

Keywords: Suitability; facilities and infrastructure; physics laboratory

I. INTRODUCTION

Physics is one of the fields of Natural Sciences that studies the phenomena that occur in the universe, so that physics is said to be a technological foundation that is reasonable enough to be given to students as a provision in facing life in the future [1]. Therefore, studying physics does not only rely on a theory, books or listening to lectures, but experiments that can support the physics theory. The existence of a physics laboratory in high school is one of the school's instruments as a supporter of success in the physics learning process, especially in terms of practicum or laboratory experiments. The achievement of goals in physics subjects at school will be seen when the process of learning physics is successful [2].

Physics laboratories can also provide support for the development, skills, habits and attitudes of students in the learning activities carried out [3]. The existence of a physics laboratory in high school will increase students' insight and can support the understanding of theories and student learning outcomes to increase compared to studying theories alone. With the existence of a laboratory, every activity in the classroom that cannot be clearly proven will be more optimal with practical learning in the laboratory.The inhibiting factor for learning in the laboratory at school is the purpose of using the laboratory which tends to be seriously ignored, even most students do not perceive the laboratory to be a very important learning experience [4].

Physics learning is very closely related to practicum activities, because physics subjects are full of theories, laws, concepts, principles, and rules about physics, all of which need good proof through practicum [5]. Physics practicum is closely related to the physics laboratory at school which contains various facilities in the form of

facilities and infrastructure that support every physics practical learning activity. A physical laboratory is an instrument or supporting facility in physics learning which is equipped with equipment and materials based on certain scientific methods to conduct an experiment [6]. In order to realize this goal, the development of a good laboratory must meet the standards set by a national educational institution, in which the standards for physics laboratory facilities and infrastructure are regulated in Ministry of National Education Number 24 of 2007.

Learning physics is essentially recognizing the natural environment and then making a product formulation in the form of formulas and correct attitudes towards these phenomena. The focus for the problems to be researched is on the suitability of facilities and infrastructure, especially high school physics laboratories, should meet the standards set by the government, such as the standards for physics laboratory facilities and infrastructure regulated in Ministry of National Education Number 24 of 2007. Several obstacles are factors that make this activity practice is less applicable or not implemented. Mastery of practicum material by educators is also a factor that can make the implementation of practicum not yet implemented and the teacher's lack of readiness to manage the laboratory properly. Then other obstacles in the implementation of the practicum are also influenced by several factors, namely laboratory facilities that are not used properly, minimal school support, poor management of physics laboratories, teachers who do not make preparations related to the implementation of practicums in the absence of laboratory assistants or technicians [7].

Therefore, the lack of several laboratory facilities and the lack of supporting facilities and infrastructure for laboratory activities are obstacles in the implementation of the practicum. Therefore, it is important to analyze the facilities and infrastructure of the physics laboratory because a laboratory for good physics learning must be in accordance with the demands of the national education minister regulation no. 24 of 2007, which is stated in Chapter 1 paragraph 1 of the Ministry of National Education Number 24 of 2007 which states that the standard of facilities and infrastructure for schools, especially high schools, must include the minimum criteria for facilities and minimum criteria for each infrastructure. The ideal condition expected in physics learning, especially practicum learning, is the optimal physics learning process or practical work activities in the laboratory supported by complete facilities and infrastructure and according to government standards to support a more optimal teaching and learning process [8].

Physics learning which only focuses on theory and without any practicum activities, reduces students' interest and motivation in learning, where the author sees students less active in learning delivered with explanations in the form of theory or learning materials, because if learning is delivered in the form of theory, it will make students less active in learning activities and tend to listen more to the teacher who teaches. The use and management of the Physics laboratory as a school facility must pay attention to the condition and quality of the facilities, because these two factors can have a direct effect on the learning process. This research was conducted to obtain information regarding the completeness of the glasses laboratory facilities and infrastructure in schools which have been adapted to the objectives of the Minister of National Education Regulation Number 24 of 2007.

II. METHOD

This type of research is a descriptive research. Descriptive research is research on phenomena that occur in the present. The process is in the form of collecting and compiling data, as well as analyzing and storing the data. The method in this research is a survey method using observation sheets with techniques for calculating the facilities and infrastructure of the Physics Laboratory. There are 2 data examined in this study, namely, primary data conducted by survey method in order to see the suitability of the Physics Laboratory facilities and infrastructure at SMA Negeri 1 Ampek Angkek. Survey research is an observation of a phenomenon that occurs in the environment, while secondary or supporting data through interviews with the head of the physical laboratory in order to obtain additional information needed [9].

In this study, the method used is a survey method using observation sheets as a data collection tool to record the results of the survey conducted. The observation sheet is adjusted to the Regulation of the Minister of National Education 24 of 2007 concerning the standard of physics laboratory facilities and infrastructure. The data analysis used is descriptive analysis, namely the statistics used to describe an object under study through the data as described and made in general [10].

The analysis used is descriptive quantitative by classifying the types of data obtained from the observation sheet. The steps of data analysis to be carried out in the study are after the data is collected, the next step is to compare the existing facilities and infrastructure with Ministry of National Education Number 24 of 2007 whether they are appropriate or not, then to find out the physical laboratory facilities and infrastructure in schools, namely by dividing the facilities and infrastructure. infrastructure that is in accordance/ideal with the total number of data facilities and infrastructure in the observation sheet then multiplied by 100% [11].

With the following formula :

$$P = \frac{F}{N} \times 100\% \qquad (1)$$

Description :

P : Percentage
F : Actual Frequency
N : Ideal and not ideal amount of data

The categories that can be seen in the results of this study are in the table of the following percentage of conformity categories:

Table 1. Conformity percentage category

Percentage	Criteria
81%-100%	Very appropriate
61%-80%	In accordance
41%-60%	Quite appropriate
21%-40%	Not suitable
0%-20%	Not very suitable

(Source: Arikunto [12])

Based on the table above, we can see that there are 5 different categories or levels of suitability, ranging from very suitable, suitable, moderately suitable, less suitable, and very inappropriate. It is from this category that we will later describe and conclude how the level of suitability of each facility and infrastructure in the physics laboratory in senior high schools.

III. RESULTS AND DISCUSSION

A. Description of Observation Results Regarding Practical Learning Facilities in the Physics Laboratory

From the results of the analysis of research data that has been carried out in the learning facilities section, it can be described about the practical learning facilities in the physics laboratory into 7 types of facilities, the graph of the percentage of data on the suitability of physics laboratory shown in figure 1.

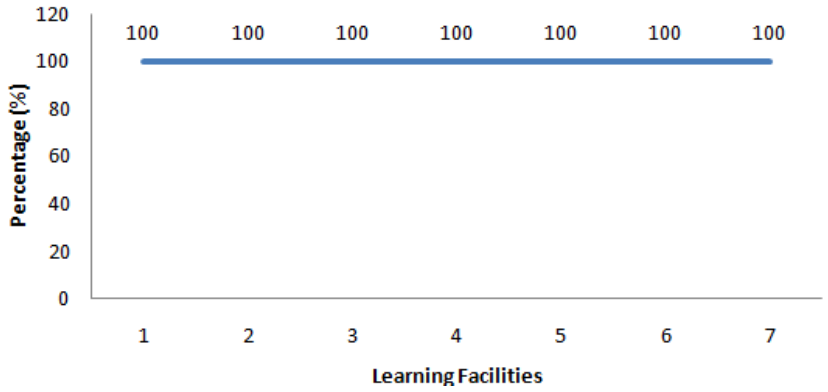

Fig. 1.Percentage of facility suitability

The graph explains that all the existing learning facilities in the physics laboratory of are in conformity level or the percentage of conformity is 100%, meaning that all the facilities studied in this study are in accordance with Ministry of National Education Number 24 of 2007 with information that is very suitable for the facilities section. Physics learning facilities in the laboratory of senior high school are very good, where every existing facility such as work desks, demonstration tables, preparation tables and sinks at every student and teacher desk has met the standards set out in Ministry of National Education Number 24 of 2007.

B. Description of observations regarding basic measuring instruments

From the results of the analysis of research data that has been carried out, it can be described about the basic measuring instruments in physics laboratory practical learning which were studied as many as 15 kinds of basic measuring instruments of physics, the percentage data on the suitability of basic measuring instruments in the physics laboratory is shown figure 2.

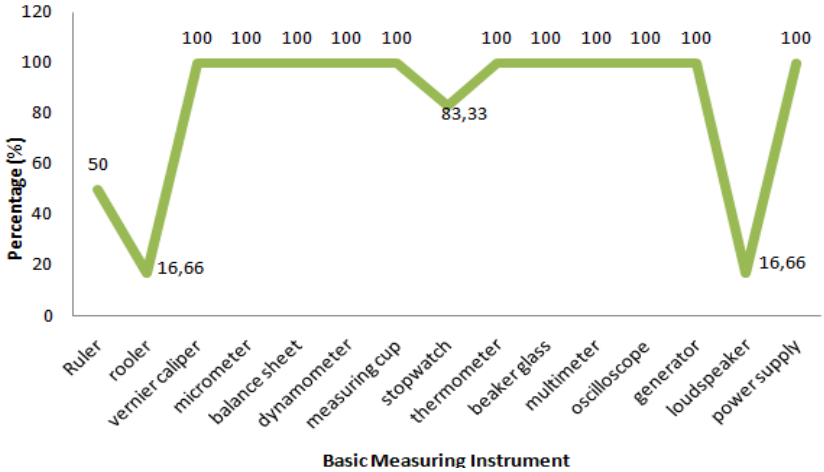

Fig. 2 Percentage of Basic measuring instrument

The figure above explains that all the basic measuring tools for practicum learning in the physics laboratory have an average level of conformity or percentage of conformity of 84.4%, meaning that this percentage can be said to be very appropriate. A total of 5 basic measuring instruments in the Physics Laboratory are not in accordance with the ideal number set by the Minister of National Education.

C. Description of the results of observations on practical materials

From the results of the analysis of research data that has been carried out, it can be described about the availability and percentage of conformity of practicum materials in the physics laboratory which were studied as many as 11 kinds of practicum materials, and the percentage of conformity of practicum materials is shown in Figure 3 below.

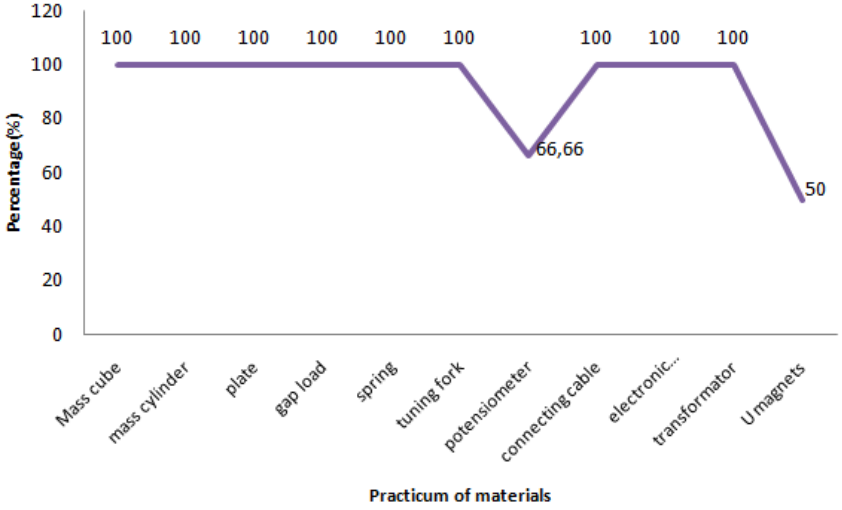

Fig.3.Percentage of practical material

The percentage of each practicum material in the physics laboratory, in the diagram it can be seen that the percentage of suitability for 9 practicum materials is in accordance with the regulations of the Minister of National Education No. 24 of 2007, two practicum materials, namely the potentiometer box with a percentage of 66.6% in the appropriate category and the U magnet with a conformity percentage of 50% is sufficient in accordance with the rules of the Minister of National Education No. 24 of 2007. As for the average percentage of

conformity of physics practicum materials in of 92.4%, which is included in the the criteria are in accordance with the candy reference used in the study.

D. Description of Observations Regarding Practical Experimental Instruments in the Physics Laboratory

From the results of the analysis of research data that has been carried out on practical experimental equipment, it can be described regarding the availability and percentage of suitability of practical experimental equipment in the physics laboratory as many as 13 types of experimental equipment, which is shown in Figure 4 below.

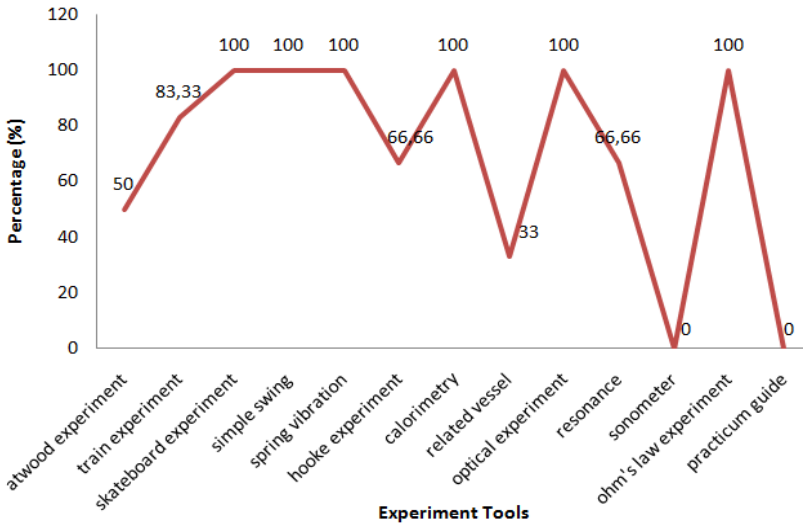

Fig. 4. Percentage of experiment tools

The experimental tools for physics practicum were studied as many as 13 kinds of experimental equipment consisting of 6 kinds of experimental equipment already in 100% conformity percentage, while for the atwwod experiment with 50% conformity percentage, train experimental equipment with a percentage of 83.33 %, hooke experiment was 66.6%, connected vessel experiment was 33%, resonance experiment was 66.6% sonometer experiment and 0% for practicum guide.The incompleteness of this experimental tool will make some practicum materials unable to work properly, such as the sonometer experiment where the existence of the experimental tool is not available in the physics laboratory, as for the recommended solution by conducting the sonometer experiment using a simple virtual lab that allows for used by students and teachers.

E. Description of observation of educational media and other equipment

Based on the results of the research data analysis that has been carried out, it can be described about educational media and other equipment in the physics laboratory practicum as many as 6 types of equipment, so the percentage of conformity of each media and equipment is shown in Figure 5.

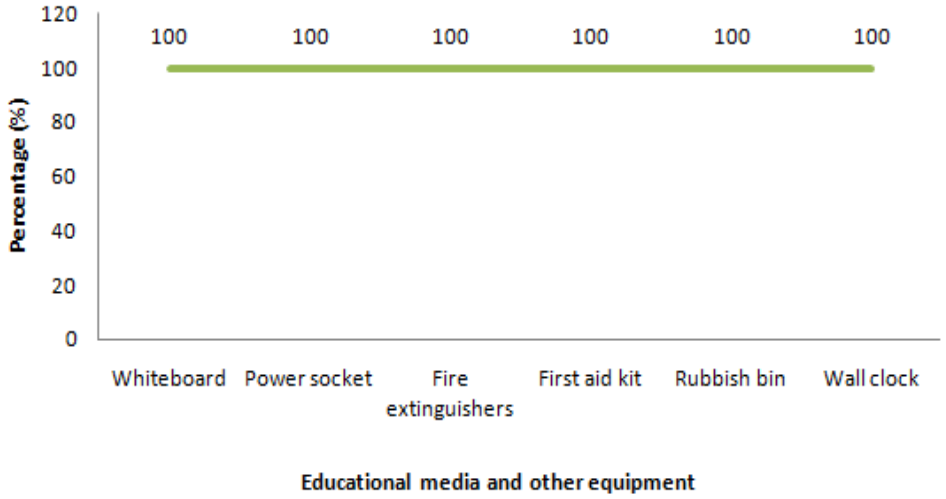

Fig.5. Percentage of educational media and other equipment

From the figure above, it is clear that all educational media and other equipment contained in the physics laboratory are in the very appropriate category, namely the percentage of conformity is 100% for all aspects studied. Educational media and other existing equipment such as electric sockets and trash cans have exceeded the minimum number stated in Ministry of National Education Number 24 of 2007.

F. Description of physics laboratory infrastructure

Based on the results of the research data analysis that has been carried out, it can be described regarding the availability and percentage of conformity of the infrastructure contained in the physics laboratory at SMA, there are 4 types of infrastructure that the researchers examined based on the demands of Permendiknas No.24 of 2007, shown in Figure 6

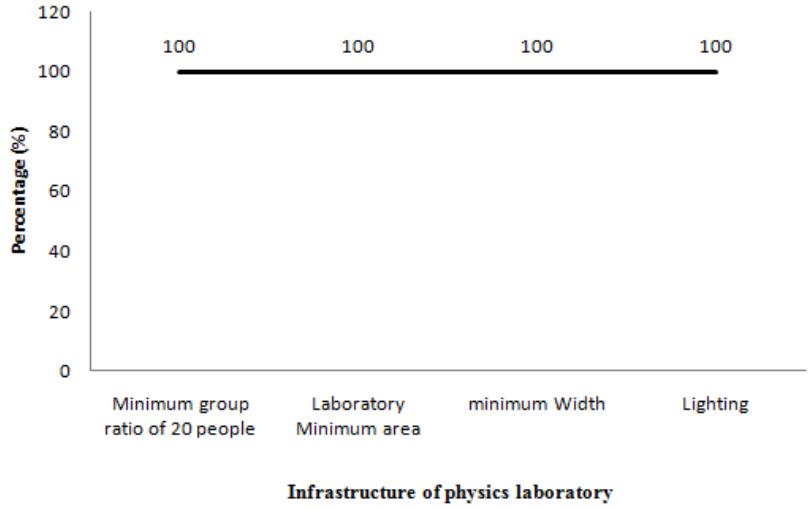

Fig. 6. Percentage of infrastructure physics laboratory

Shown from all the existing learning infrastructure in the physics laboratory in the level of conformity or the percentage of conformity of 100%, meaning that all the infrastructure studied in this study was in accordance with the Minister of National Education Number 24 of 2007 with information very suitable for that part of the infrastructure. For the four types of infrastructure studied, namely with information above the minimum standards set in Ministry of National Education Number 24 of 2007.

G. Description of the level of suitability of each facility and infrastructure

Data from observations from all existing facilities and infrastructure in the physics laboratory are divided into 6 types of facilities and infrastructure, namely each facility and infrastructure has a different level of suitability shown in Figure 7 below.

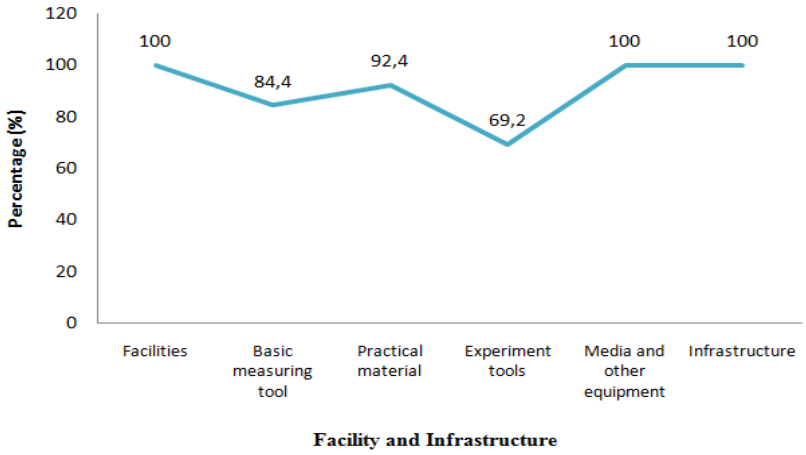

Fig.7. Average percentage of each facility and infrastructure

All physics practicum learning facilities and infrastructure in the laboratory are divided into 6 types of infrastructure which include facilities, basic measuring instruments, practicum materials, experimental tools, media and educational infrastructure. All the facilities and infrastructure studied obtained results with different suitability percentages. It can be described in detail all the physics laboratory facilities and infrastructure studied, suggestions for learning physics with an average percentage of conformity of 100%, namely the very appropriate suitability category. from other relevant studies, it shows that the management of the physics laboratory in schools has fulfilled the spatial aspects of the schools studied in accordance with infrastructure standards, while there are two other schools that are not in accordance with established standards.

Based on the results of the conformity percentage for all experimental instruments, facilities and infrastructure that have been adjusted to Ministry of national education Number 24 of 2007 with an average percentage of 84.4%, which is in the category very according to the standards set, namely with a value of 81-100 which states the level the suitability of the criteria is very suitable. Thus the physics laboratory facilities and infrastructure have a very high level of conformity in accordance with the regulations of the Minister of National Education.

Learning facilities and infrastructure in the physics laboratory are equipped with various kinds of tools, materials, experimental equipment as well as useful learning facilities and infrastructure to support a better quality of physics learning, especially in practicum learning in the physics laboratory. With the existence of good and complete laboratory facilities and infrastructure as seen in several complete facilities and infrastructure in the physics laboratory it is hoped that teachers and students who carry out learning activities in the laboratory can utilize every existing facility and infrastructure so that all students can be involved and actively participate in practice learning.

Learning in the laboratory as we know that practicum learning can develop students' basic abilities, in this case students are trained to develop the ability to understand a concept. By training students' abilities to observe objects carefully, measure, use and handle tools safely to design a practicum activity, and can increase students' ability to participate in learning, both individually and in groups through the principles of the scientific method from practicum activities carried out at laboratory.

Based on the results that have been obtained, even though the suitability category is very high, if you look in detail at each experimental tool, practicum materials and existing facilities, there is a percentage and number of tools in each experimental tool that are still low or low. not even there. The lack of management of physics laboratories in schools is due to the lack of handling from the school in carrying out work activities in the laboratory and the standard of facilities and infrastructure has not been fully fulfilled. From the several aspects of the constraints above, it is also related to the research by Imastuti, which states that the condition of laboratory management in schools is due to the absence of management staff and teachers who are busy teaching in class, so that laboratory management does not run optimally. In order to maintain the continuity, efficiency and utility of the laboratory, the laboratory needs to be managed properly; one part of management is laboratory staff or officers [13]. This is also reinforced by research by Vincent said that much needs to be done to assist teachers in

engaging their students in the school science laboratory experience by optimizing the potential of laboratory activities as a unique and important medium that encourages learning science concepts.and procedures, the nature of science, and other important goals in science education [14].

The solution that the teacher can do later is for some incomplete practicum experiment tools, the teacher can take advantage of the virtual lab if conditions allow for virtual practicum. Another solution that can be done to practicum problems in schools is to provide training to teachers on good and correct laboratory management techniques, as well as to increase teacher motivation in carrying out practicum training by providing simple and fun practicum training to students.

IV. CONCLUSION

Based on the results of data analysis that has been carried out by data from a survey of physics laboratory facilities and infrastructure and interviews that have been carried out, namely learning facilities in the physics laboratory have a level of conformity based on ministry of national education No. 24 of 2007 of 100%, namely in the very appropriate category, basic measuring instruments with a percentage of 84.4% with a very suitable category, 92.4% practicum materials in a very suitable category, 69.2% experimental tools with a suitable category, for educational media and other equipment and infrastructure with a percentage of 100% with a very appropriate category. Thus the physics laboratory has a percentage level of conformity of 90% with a very suitable category, based on Ministry of National Education No. 24 of 2007.

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