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Analysis of the Utilization of Physics Laboratories in State Senior High Schools in Luwu Regency

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Abstract - *This study aims to analyze the utilization of the physics laboratory and identify the factors causing the non-optimal use of the physics laboratory in state senior high schools throughout Luwu regency. This research is a survey research with a quantitative approach. Data analysis used descriptive analysis in the form of percentages involving three high schools in Luwu district, namely SMAN 12 Luwu, SMAN 7 Luwu, and SMAN 1 Luwu. The total number of student respondents was 223 students with 103 students at SMAN 12 Luwu, 56 students at SMAN 7 Luwu, and 64 students at SMAN 1 Luwu. In addition, there were 2 teachers in each of the three schools who were used as respondents. Data were collected by observation, questionnaires, and interviews. The results showed that the use of physics laboratories in state senior high schools throughout Luwu regency for practicum activity planning indicators was in a good category, teacher readiness indicators were in a good category, indicators for the implementation of practical activities were in a good category, and indicators for the availability of practicum tools were in the less category. This study concludes that not all indicators of the use of physics laboratories in state senior high schools throughout Luwu Regency are in a good category. The factor causing the non-optimal use of the physics laboratory is the incomplete availability of tools and practicum materials in schools.*

Keywords: *Luwu regency; physics laboratory; practicum; survey*

I. INTRODUCTION

The management of physics laboratories in each school certainly has obstacles in the implementation of practicum, not only due to the lack of a set of material tools, but also other factors, such as the management of the physics laboratory which is still far from standard or the absence of laboratory technicians so that the practicum equipment cannot function optimally. In order for the use of the laboratory to run well, the laboratory must be managed properly with the support of laboratory management. Barnawi & Arifin (2012) explain that management can be defined as the activity of managing various resources by cooperating with other parties through certain processes to achieve a goal effectively and efficiently. In addition, in order for laboratories in schools to function properly, laboratories must have facilities for learning activities, administrative activities, and storage of laboratory equipment.

According to Sutrisno (2011), the implementation of laboratory activities is tangible evidence of all the planning of laboratory activities that have been carried out previously. In order for this to be carried out properly, the implementation of laboratory activities must pay attention to several points, for example understanding correctly and being willing to carry out their obligations as planned. In addition, each implementer of laboratory activities must comply with applicable laboratory rules and procedures. Data on the implementation of laboratory activities must also be recorded properly, for example, attendance lists, laboratory usage lists, laboratory equipment usage lists, and reports on laboratory activities.

Based on an initial survey conducted by researchers on August 26, 2019 at the physics laboratory of SMA Negeri 12 Luwu, it was found that the physics laboratory was poorly maintained and rarely used. This is because the physics teachers at the school are more involved in teaching activities in the classroom. In addition, the incompleteness of physics laboratory equipment is also a major factor why laboratory activities are rarely carried out. According to the physics subject teacher at the schools surveyed, there are several subject topics that should be practiced in the laboratory, but due to limited tools and materials, learning is carried out only by learning theory in class.

Previous studies have shown the importance of practical activities in learning physics. According to Bancong and Putra (2015), through practical activities, students actively construct concepts, laws or principles through the stages of observing, formulating problems, proposing hypotheses, collecting data, analyzing data, drawing conclusions and communicating concepts, laws or principles of physics. Therefore, through practical activities, students' science process skills in the form of skills in observing, classifying, communicating, measuring, predicting, and concluding can be increased (Bancong & Putra, 2015; Syam et al., 2015; Satrio & Sabani, 2018). By increasing student process skills, it will also have an impact on their understanding of physics concepts (Marisda, 2016).

Therefore, the purpose of this study was to analyze the utilization of the physics laboratory at the state senior high school in Luwu Regency and to identify the factors that influence the utilization of the physics laboratory. The research questions are as follows:

1) What is the description of the use of physics laboratory in state senior high schools in Luwu regency?
2) What are the factors that cause the not optimal utilization of the physics laboratory in state senior high schools in Luwu regency?

II. METHODS

This research is a survey research with a quantitative approach. Survey research is a type of research that collects information about the characteristics of opinion actions from a group of representatives, which are considered as the population (Sugiyono, 2015). In survey research, samples are taken from one population using a questionnaire as the main data collection tool.

Respondents in this study were drawn from 3 different schools in Luwu Regency: SMAN 12 Luwu, SMAN 7 Luwu, and SMAN 1 Luwu. Each respondent consists of students and teachers. The total number of student respondents was 223 students with details of 103 students at SMAN 12 Luwu, 56 students at SMAN 7 Luwu, and 64 students at SMAN 1 Luwu. While the total teacher respondents were 6 teachers, each consisting of 2 teachers from each school.

The instrument used in this study is an observation sheet which is used to see the actual condition of the physics laboratory at school. The other instrument was a questionnaire that was given to physics teachers and students to find out their responses. An interview guide was also prepared as a guide in asking some questions to physics teachers regarding the use of physics laboratories in schools.

The research procedure can be seen in Figure 1. As we can see, the research procedure has three major stages. First, the research preparation stage. At this stage, the researchers plan and arrange all forms of instruments needed in the research. The instruments compiled in collecting research data consisted of (a) questionnaires for teachers regarding the use of physics laboratories including planning practicum activities, teacher readiness, implementation of practicum activities, use of practicum facilities, application of work safety, ethics in practicum and laboratory conditions; (b) a questionnaire for students about the use of the physics laboratory covering the readiness of students, the implementation of practicum activities, and the availability of practicum tools; (c) the observation sheet on the use of the physics laboratory to see the completeness of the physics practicum equipment in the laboratory; and (d) interview guide with questions about planning practicum activities, teacher readiness, and utilization of practicum facilities.

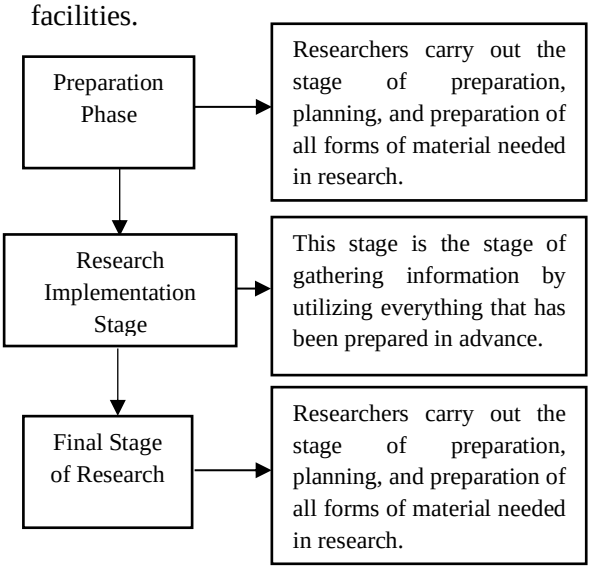

Figure 1. Research procedure

Second, the stage of research implementation. In this stage, data is collected by utilizing everything that has been prepared in advance. Activities that have been carried out at this stage include (a) giving questionnaires to research subjects, namely teachers and students to obtain data or information related to the use of physics laboratories; (b) Observing the research subjects. The observations were made to see how the research subjects conducted activities in the physics laboratory and see the compatibility between the conditions on the ground and the devices that had been made before; (c) conducting interviews with research subjects aimed at finding information related to the use of physics laboratories. The final stage of research activities are researchers analyzing data obtained from research results, discussing the results of data analysis, and concluding research results.

The data collected is then analyzed descriptively. Qualitative data from observations and interviews are described by summarizing the results. The data on the use of the physics laboratory for the use of the physics laboratory in Luwu Regency was obtained from a questionnaire of physics teachers and students.

III. RESULTS AND DISCUSSION

The results of the descriptive statistical analysis of the use of the physics laboratory at SMAN 12 Luwu can be seen in Table 1. As can be seen, the results of the percentage of teacher questionnaires on the practicum activity planning indicators are in the range of 71% -85% in the good category. The teacher readiness indicators are also in the 71%-85% range in the good category. While the indicators for the implementation of practicum activities are in the range of 56% - 70% in the enough category, and indicators for the availability of practicum tools are only in the range of 41%-55% included in the less category.

Table 1. The utilization of physics laboratory at SMAN 12 Luwu

Indicators	Interval	Category
Practicum activity planning	71%-85%	Good
Teacher readiness	71%-85%	Good
Implementation of practicum activities	56%-70%	Enough
Availability of practicum tools	41%-55%	Less

The utilization of physics laboratory at SMAN 7 Luwu can be seen in Table 2. As shown, the percentage of teacher questionnaires on the practicum activity planning indicators are in the range of 71% - 85% in the good category. The teacher readiness indicators and the implementation of practicum activities indicator are in the 86%-100% range in the excellent category. On the contrary, the indicators for the availability of practicum tools are only in the range of 41%-55% included in the less category.

Table 2. The utilization of physics laboratory at SMAN 7 Luwu

Indicators	Interval	Category
Practicum activity planning	71%-85%	Good
Teacher readiness	86%-100%	Excellent
Implementation of practicum activities	86%-100%	Excellent
Availability of practicum tools	41%-55%	Less

The utilization of physics laboratory at SMAN 1 Luwu can be seen in Table 3. As shown, the percentage of teacher questionnaires on the practicum activity planning indicators are in the range of 71% - 85% in the good category. The teacher readiness indicators are in the range of 56%-70% in the enough category. The other two indicators, the implementation of practicum activities and the availability of practicum tools, are both in the range of 71%-85% in the good category.

Table 3. The utilization of physics laboratory at SMAN 1 Luwu

Indicators	Interval	Category
Practicum activity planning	71%-85%	Good
Teacher readiness	56%-70%	Enough
Implementation of practicum activities	71%-85%	Good
Availability of practicum tools	71%-85%	Good

Based on the three tables above, the indicators for planning practicum activities in the three high schools are not yet in the excellent category. This is because, at SMAN 12 Luwu, the teacher divides the practicum schedule for each class. The schedule that has been made sometimes does not match the number of students who will carry out practical activities. So those practicum activities that should be carried out 12 times in one semester, are only carried out 4 times. Likewise, at SMAN 7 Luwu and SMAN 1 Luwu, the teacher himself divides the practicum schedule for each class and prepares the tools and materials to be used before starting the practicum because there is no laboratory assistant.

In the indicator of teacher readiness, teachers at SMAN 12 Luwu are only in the good category. This is because the school does not have a laboratory assistant so the teacher himself carries out all practicum activities such as preparing tools and practicum materials, tidying up the tools and practicum materials, and reminding students to comply with laboratory rules and regulations. This is different at SMAN 7 Luwu which is in the excellent category. That is because apart from having a laboratory assistant, teachers also collaborate with other physics subject teachers to prepare tools and practicum materials to be used. So that the practicum activities run well and the teacher only directs students to the laboratory room. On the other hand, SMAN 1 Luwu is only in the enough category. This is because there is no laboratory assistant at the school. In addition, teachers often have difficulty in preparing practical tools and materials due to limited knowledge about them

In the indicators for the implementation of practicum activities, SMAN 12 Luwu is in the enough category. This is because the physics practicum activities at the school can

be handled properly. Students can do practical work well according to the instructions that have been provided and the tools and materials that can be cultivated by the school. Practical activities are made in groups to make it easier for teachers to supervise and guide students. The practical instructions are summarized by the teacher based on the material in the book in a practicum module. On the other hand, the implementation of practicum activities at SMAN 7 Luwu is in the excellent category. This is because the practicum is carried out during teaching and learning activities. The practicum was not carried out suddenly, but one week earlier the teacher had coordinated with other teachers to prepare it. The teacher gives instructions to students regarding the material, practicum steps, and the use of practicum tools so that the students can do practicum well. Then, the implementation of practicum activities at SMAN 1 Luwu is in a good category because it is carried out in the afternoon outside of teaching and learning activities. However, some of the experiments carried out during these activities were light and did not take long. The topics that are practiced are usually only those that are included in the national exam so that students better understand the material.

Furthermore, on the indicator of the availability of physics practicum tools, SMAN 12 Luwu is in the less category. Based on observations, not all tools and practicum materials are available in the lab. The lack of completeness of physics practicum tools and materials in schools makes teachers unable to carry out practical activities in accordance with the material that should be practiced. Due to the limitations of practical tools, the teacher only provides theoretical learning in class. Likewise with SMAN 7 Luwu which is in the less category. The results of observations also show that the tools and practicum materials are incomplete. The availability of physics practicum tools at SMAN 1 Luwu is in a good category because the physics teacher at the school asks students to bring available practicum tools around them related to the physics material to be practiced.

The results obtained in this study are in line with research conducted by Asih et al. (2013) that laboratory management in SMK 2 Negara is less than optimal. Procurement of chemicals only, while tools are rarely carried out. In addition, the placement and maintenance of tools and materials is not good. Whereas the results of the elaboration of chemical laboratory standards at SMK Negeri 2 Negara can be effective in achieving adaptive chemistry competence if the tools and materials needed in the practicum are available (Asih et al., 2013). A research by Awitaningsih et al. (2012) also found that the utilization of physics laboratory equipment in state senior high schools in Banyuwangi regency is still very low and has not been utilized optimally in supporting the implementation of physics learning. Whereas the use of laboratory equipment is directly related to improving

student performance. When students are exposed to the use of this equipment, they tend to perform better than they would without this facility (Ihejiamaizu et al., 2016; Yanti & Yushardi, 2016).

Ekosari et al. (2018) stated that the effectiveness of laboratory use is influenced by the availability of facilities and infrastructure in supporting the learning process. With good facilities in each school, it can increase the activeness of students in learning and can effectively carry out practicum activities in accordance with the demands of the curriculum (Ekosari et al., 2018). Lubis et al. (2017) also argued that the use of laboratories in schools through practical activities aim to give students the opportunity to test and implement in real situations what they obtained in theory. Practical activities in science learning are important things to do (Lubis et al., 2017).

According to Manlea et al. (2017), school science laboratory activities cannot be categorized as good if the absence of laboratory stock cards, lists of tools and materials for each practicum implementation, labels, request formats for tools and materials, semester program of laboratory activities, activity journals and schedule of laboratory activities. There are several factors that cause the low utilization of laboratories in schools, namely a) there is still a physics laboratory room which is also used as a classroom for learning; b) there is still a physics laboratory room that is still integrated with other laboratory rooms; c) absence of laboratory technicians; and d) lack of understanding of physics teachers about the importance of innovation in learning (Katili et al., 2013). The absence of laboratory technicians causes laboratory administration to be unavailable such as damaged, lost notebooks, out of stock items, and others (Adilah et al., 2021).

The effectiveness of the use of the laboratory is influenced by the availability of facilities and infrastructure in supporting the process of learning activities. With good facilities in each school can increase student activity in learning and can effectively carry out practical activities in accordance with the demands of the curriculum (Mastika et al., 2014; Istiqomah et al., 2016). The results of Safriana's research (2017) revealed that there is a positive and significant influence between the ability to use electrical measuring instruments on students' psychomotor abilities in basic electronics practicum. The use of high school laboratory facilities and infrastructure also affects the implementation of physics practicum and student learning outcomes (Suseno & Riswanto, 2017). In addition, through practical activities, students' science process skills in the form of skills in observing, classifying, communicating, measuring, predicting, and concluding can be increased (Bancong & Putra, 2015; Syam et al., 2015). By increasing student process skills, it will also have an impact on their understanding of physics concepts (Marisda, 2016).

IV. CONCLUSION AND SUGGESTION

Based on the results of the study, it can be concluded that the utilization of the physics laboratory in state senior high schools in Luwu regency on the indicators for planning practicum activities are in the good category, the teacher readiness indicators are in the good category, the indicators for the implementation of practicum activities are in the good category, and the indicators for the availability of practicum tools are in the less category. The factor causing the non-optimal utilization of the physics laboratory in state senior high schools at the Luwu regency is the incomplete availability of tools and practicum materials.

Based on the results of the study, it can be suggested that every school should be more serious in proposing a program for renewing tools and materials for physics practicum. In addition, the government should pay more attention to the availability of tools and practicum materials in physics laboratories in every school. The availability of tools and materials in schools is highly dependent on laboratory activities carried out by teachers and students.

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