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Laboratory Management; Challenges and Opportunities in Fkip Uhamka

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ABSTRACT: This study aims to analyze the management of basic physics laboratories at Universitas Muhammadiyah Prof DR HAMKA and its impact on user performance and satisfaction. Optimal management of basic physics laboratories is very important to support the learning process and student practicums. This study uses a descriptive method with a quantitative approach, where data is collected through questionnaires distributed to lecturers and students who use the laboratory. The results of the study indicate that the management of basic physics laboratories at Universitas Muhammadiyah Prof DR HAMKA has been running well, but there are still several aspects that need to be improved, such as equipment maintenance, additional facilities, and improving work safety. Data analysis shows that there is a significant relationship between laboratory management and user performance and satisfaction. Good management will improve the efficiency of laboratory use, which in turn will improve academic performance and user satisfaction. Based on the findings, several suggestions are given for further improvement, including planning for periodic maintenance, adding facilities, improving laboratory technician skills, and regular monitoring and evaluation. The implementation of these suggestions is expected to improve the quality of basic physics laboratory management at Universitas Muhammadiyah Prof. DR HAMKA.

KEYWORDS: Laboratory Management, Challenges, Opportunities, Basic Physics Laboratory

INTRODUCTION

In supporting the quality of education in Indonesia, the provision of learning facilities and infrastructure is required to be adequate, because educational facilities and infrastructure are mandatory components and are very important to be utilized so that the teaching and learning process can be carried out optimally. The utilization of facilities and infrastructure in schools, one of which is the utilization of laboratories. Laboratories can provide support for students' knowledge and understanding of facts, principles and concepts. A laboratory is a place that can be used as a facility to improve and develop skills in conducting scientific experiments (1). The laboratory is a characteristic of a place that has an important role and is very necessary, especially for subjects included in Science lessons (2). Based on the results of research by Tomy Suherly 2022, it was stated that practical activities and students' understanding abilities can be improved through direct practical activities (3).

Laboratory management is an effort to manage a laboratory so that it has good governance. Laboratory management can be managed well, it is very much determined by several factors that are interrelated with each other. Some sophisticated laboratory equipment, with skilled professional staff, may not necessarily operate well if not supported by good laboratory management. Therefore, laboratory management is an inseparable part of laboratory activities. Good laboratory management has a good organizational system, clear job descriptions, Good laboratory management has a good organizational system, clear job descriptions, efficient, effective use of facilities, discipline and good laboratory management (4). In other words, all activities in the laboratory are not directed in terms of growth and development, aka sterile in research productivity. The bad impact is that all activities of applying scientific theory, theoretical testing, trial proof, and research carried out in the laboratory will always run suddenly (incidentally) (5).

According to Tone a laboratory is a room, either closed or open, which is designed according to the needs to carry out activities related to educational functions, research and community service(6). The laboratory is a characteristic place that has an important role and is very necessary, especially for subjects that are included in Science lessons (2). Based on the results of research by Tomy Suherly 2022, it was stated that practical activities and students' understanding abilities can be improved through direct practical activities. In order for the laboratory to function properly, the laboratory must be managed properly, and good laboratory management must be supported by good laboratory management as well. According to Adriani the better the implementation of laboratory management, the more competent it is (7).

Science, especially physics, is a science that is very close to nature and life, so that physics education and teaching should be carried out with fun methods and using media that are close to life, one of which is by utilizing the Physics Laboratory. Management of education, especially in relation to laboratories, is identical to problems that are often quite complicated. Resource problems are often an obstacle in managing the course of education in the laboratory. Ideally, a student gets maximum facilities in the practice that must be done in the learning process, but often limited resources make students have to take turns doing laboratory practicums with limited time during office hours. In fact, often the number of resources is not comparable to the number of students. In line with that, Emda stated that the laboratory is a means of learning chemistry in improving scientific work skills (8). This means that, the service aspect in the implementation of practicums needs to be continuously improved in order to improve skills for student practitioners. The results of improving the quality of service, simply, will be seen by the presence or absence of complaints from practitioners.

The central role of the laboratory in improving basic experimental skills in the learning process, especially physics learning according to the curriculum, shows the importance of good management, in laboratory management through planning, organizing and implementing research (9). Generally, a laboratory must be equipped with safety equipment, for example in laboratories that often use electrical equipment, so that safe electrical safety is needed (10). Not only on electrical equipment, several other practicums carried out in the Physics laboratory need to consider the safety of the practicum based on the characteristics of the practicum (11).

In supporting the quality of education in Indonesia, the provision of learning facilities and infrastructure is required to be adequate, because educational facilities and infrastructure are mandatory components and are very important to be utilized so that the teaching and learning process can be carried out optimally. Utilization of facilities and infrastructure in schools, one of which is the utilization of laboratories. This was also expressed that in addition to internal factors, external factors of students also greatly contribute to the success of students in their education, one of which is laboratory facilities and infrastructure (12). According to laboratories can provide support for students' knowledge and understanding of facts, principles and concepts (13). Knowledge and research can be obtained from various sources through activities in the laboratory and student knowledge can be strengthened.

The quality of service in the basic physics laboratory is continuously improved by making improvements in terms of program revisions and practical guidance, laboratory training, assistants are intended to meet the demands of user needs, namely practitioners. In relation to this, an evaluation is needed for input for service improvement. In this case, suggestions and criticisms are seen as reciprocal materials needed for the progress of the laboratory institution. One of the evaluations for improvement can be done by using indicators of laboratory user perception, in this case students/practice students. Thus, in order to produce a good perception, continuous efforts are needed so that the basic physics laboratory as an institution can improve in order to improve practical services in the future. In line with that, the perceptions of students/practice students must be appreciated and used as evaluation materials for institutional improvement.

RESEARCH METHOD

This research method is a descriptive study that aims to describe the management of basic physics laboratories and their effects on user performance and satisfaction, the purpose of using descriptive methods in this study is to describe factually and accurately the properties and relationships between phenomena being investigated so as to obtain information about the current situation and see the relationship between variables (14). This research was conducted at the Basic Physics Laboratory of the FKIP, Muhammadiyah University of Prof. DR HAMKA. The population in this study were all laboratory managers, lecturers, and students who used the Basic Physics Laboratory of the FKIP, Muhammadiyah University of Prof. DR HAMKA. Purposive sampling method, consisting of Laboratory Managers: Basic Physics Laboratory Assistants. While the sample for laboratory users were Basic Physics 1 students and Physics Education Lecturers.

The data collection technique used by researchers in this study was a questionnaire, to measure laboratory management, user performance (lecturers and students), and user satisfaction with laboratory services. Observation sheets were used for direct observation of basic physics laboratory management, Laboratory Management Questionnaire: Measuring aspects of laboratory management, such as maintenance, safety, and service, User Performance Questionnaire: Measuring the performance of lecturers and students in using the laboratory. And User Satisfaction Questionnaire: Measuring lecturer and student satisfaction with laboratory services based on indicators of reliability, responsiveness, empathy, assurance, and real evidence. Decision making from each calculation result was carried out based on the following decision-making criteria.

Table 1. Decision-making criteria [15]

Interval	Criteria
81 % -100 %	Very Good
61 % - 80 %	Good
41% - 60 %	Good enough
21% - 40 %	Not Good
0 % - 20 %	Very Bad

Data Analysis used in this study is data analyzed using descriptive percentage analysis. While descriptive percentage analysis is used to describe the condition of laboratory management, user performance, and user satisfaction clearly and measurably. to further determine the benefits and impacts that exist (16). The questionnaire and observation sheets were analyzed using descriptive percentage analysis, with the formula:

$$\% = \frac{n}{N} X\ 100\%$$

DISCUSSION RESULT

Physics Laboratory Management ,Laboratory management is obtained through the process of filling out questionnaires by laboratory assistants. The summary of laboratory management percentage data can be seen in table 2.

Table 2 Laboratory Management

Assessed Aspect	Percentage	Criteria		
Planning	Lab Operational	72%	87,3%	Very Good
	Lab support tools/media	100%		
	Lab facilities	90%		
	Practicum	87%		
Administration	Equipment	75%	79,5%	Good
	Materials	80%		
	Facilities and tools /materials	83%		
	Lab Use	80%		
Arrangement and storage	Tools	75%	76,7%	Good
	Materials	80%		
	Lab support facilities	75%		
Work safety	Comply with procedures	63%	62,5%	Good enough
	Using a lab coat	62%		
Maintenance	Cleaning	70%	67,5%	Good
	Storing	70%		
	Tools	60%		
	Inventorying	70%		
Monitoring and Evaluation	Preparation	80%	80,7%	Good
	Procedure	80%		
	Service	82%		

Based on Table 2, it can be seen that the planning process is in the very good category. Laboratory operational planning is still not optimal in the process of implementing laboratory planning because there is no planning of the maintenance schedule for laboratory equipment or supporting media, as well as the maintenance schedule for laboratory supporting facilities. Storage of materials shows good results because the supporting materials for the practicum are placed in a storage cabinet separate from the equipment cabinet and stored according to laboratory management standards. All tools are placed entirely in the storage cabinet because there is no storage warehouse. This causes the tools that are often used to be only the tools that are easiest for managers to reach when taking the tools, so that the frequency of tool use is not evenly distributed.

Arranging the practicum table and chair in a comfortable position and with a distance that is not too close is still difficult to do because the ratio of the laboratory area and laboratory users is no longer ideal. This laboratory also does not have a demonstration table so this is what causes the value obtained for the arrangement and storage of laboratory facilities to be in the fairly good category.

Equipment maintenance is also in the good category. The absence of a regular inspection schedule for laboratory equipment and supporting facilities causes maintenance to be carried out only if there are complaints and if damage is found to the equipment or facilities. The repair process for minor damage is carried out by the laboratory technician himself, while if the damage is severe, it will be handled by a technician from another place or the laboratory technician will submit a request to purchase new equipment. In this study it was found that occupational safety is very low and in the category of quite good. The absence of occupational safety procedure posters and K3 appeal posters in the laboratory, incomplete first aid equipment and lack of laboratory knowledge about K3 handling are the reasons for the low quality of laboratory management in terms of occupational safety.

This physics laboratory is located in Building D Fkip Universitas Muhammadiyah Prof DR HAMKA, This room is not located in line with the wind direction and there is no drainage that passes through the laboratory building, this is in accordance with the category of a good laboratory building. In addition, this laboratory is located in an integrated laboratory building complex so that it is close to other rooms so that it greatly supports the accessibility of the laboratory so that it is easy to control and also easy to reach. The results of the observations are presented in Table 3 below.

Table 3. Percentage of Basic Physics Laboratory Conditions

Assessed Aspect	Percentage	Criteria
Physical Building of Lab	70%	Good
Lab Facilities	80%	Good
Equipment Storage	75%	Good
Administration	60%	Good enough
Maintenance	60%	Good enough
Occupational Safety	58%	Good enough

The large number of items in this laboratory is because this laboratory does not have a preparation room, tool storage room, dark room and does not have a chimney room for practicums related to the combustion process. The Basic Physics Laboratory is a room without partitions that is used for all Basic Physics practicum activities.

Performance of Physics Laboratory Users ,The laboratory is greatly influenced by the performance of the manager during the service of the lecturers' needs while working in the laboratory. The percentage of lecturer performance is presented in Table 4 below.

Table 4 Presentation of Lecturer Satisfaction Performance

Performance Factors	Percentage	Criteria Factors
Knowledge	82.25%	Very Good
Skill	80 %	Good
Motivation	80 %	Good
Role	60%	Good enough

The knowledge factor of lecturers as laboratory users can be categorized as very good. Lecturers often use the laboratory according to the laboratory usage schedule, and they always confirm in advance with the laboratory assistant if they want to use the laboratory outside the usage schedule.

The motivation factor that has been given by respondents while working in the laboratory can be categorized as good. The majority of lecturers often direct students to sit neatly and work safely. Most lecturers stated that they never filled out the laboratory usage book before using the laboratory because the laboratory assistant never reminded them and some stated that it was because the laboratory assistant rarely advised lecturers to fill out the laboratory usage book before and after using the laboratory equipment/materials. Based on this description, the role factor can be categorized as quite good.

The performance of students as laboratory users is greatly influenced by the performance of managers during the service of students' needs while working in the laboratory. The percentage of student performance is presented in the following table 5.

Table 5 Student Performance Percentage

Performance Factors	Precentage	Criteria Factors
Team Cohesion	84,2 %	Very Good
Cohesiveness	83,7 %	Very Good
Team Structure	84,2 %	Very Good
Team Roles	84 %	Very Good
Norms	81%	Very Good

It can be seen from table 5 that the performance of students as users can be categorized as very good. The team cohesion factor can be categorized as very good. Students will immediately report to the laboratory assistant if an accident occurs during the practicum and the majority of students are responsible if they damage/lose laboratory equipment. The cohesiveness factor can be categorized as very good. Students as laboratory users use practicum equipment correctly in accordance with usage procedures and maintain work safety in the laboratory by complying with the rules and regulations in the laboratory. The team structure factor can be categorized as very good. Students always carefully check all equipment and materials before use. This needs to be done to ensure the quality of the equipment/materials to be used.

The team role factor can be categorized as very good. In supporting laboratory activities, students prepare themselves well before participating in laboratory practicums, ask for instructions from the laboratory assistant first if using hazardous chemicals and report to the laboratory assistant if there is damage or breaking of laboratory equipment. In doing so, the laboratory assistant always helps when students have difficulty finding information, but students feel helped in using tools/materials because the laboratory assistant is skilled in helping students solve problems faced by users in finding information and tools and materials needed by users when working in the laboratory.

The norm factor can be categorized as very good. In terms of preparation, students enter the laboratory in an orderly manner, students' attention when dealing with tools/materials such as taking tools and materials for practical work in an orderly and organized manner has been good. Not only is the preparation for practical work good, students also carry out practical work in an orderly manner. The results of measuring the performance of Basic Physics laboratory managers by lecturers of the Physics Education Study Program and students of the Basic Physics I course are presented in the following table 6.

Table 6 Percentage of user responses to the performance of laboratory managers

Performance Factors	Lecturers		Students	
	Precentage	Criteria Factors	Precentage	Criteria Factors
Knowledge	81%	Very Good	60%	Good enough
Skill	81.25%	Very Good	58%	Good enough
Motivation	78%	Good	60%	Good enough
Role	81%	Very Good	60%	Good enough

This shows that the performance of the manager observed by the user still needs to be improved because the user feels less helped by the laboratory assistant. This is in accordance with the research of Yuli Farida conducted in the physics laboratory of SMA Negeri 1 Sendawar, it turns out that the use of the physics laboratory as a means of practical activities in West Kutai Regency is categorized as less than good (17).

Laboratory User Satisfaction ,the satisfaction of Basic Physics laboratory users is the satisfaction felt by users during the service received from the manager and the attitude that arises during the work in the Basic Physics laboratory. The service received can be observed through 5 performance quality factors, namely reliability, responsiveness, assurance, empathy, and tangible. The percentage of the results of the questionnaire is presented in the following table 7.

Table 7 Basic Physics Laboratory User Satisfaction

Satisfaction Factors	Lecturers		Students	
	Precentage	Criteria Factors	Precentasi	Criteria Factors
Reability	56%	Quite Satisfied	50%	Quite Satisfied
Responsiveness	78%	Satisfied	52%	Quite Satisfied
Assurance	60%	Quite Satisfied	56%	Quite Satisfied
Emphaty	81%	Very Satisfied	65%	Satisfied
Tangible	81%	Very Satisfied	53.96%	Quite Satisfied

The reliability factor obtained a fairly satisfactory category. The majority of lecturers stated that they could not use the tools/materials easily because there were no standard operating procedures (SOPs) listed/located near the tools/materials. Only a small number of tools/materials had standard operating procedures (SOPs) and were labeled. Meanwhile, according to students, laboratory assistants were not always ready and knew what was needed by users/practitioners and did not always help when students had difficulties and could provide solutions to the problems faced.

The responsiveness factor obtained a satisfactory category. Most lecturers stated that they could find the tools/materials needed easily because there was a list of tools/materials in each storage cabinet, while the responses given by students were in the fairly satisfactory category, because according to students, laboratory assistants were not responsive to problems faced by students in finding tools/materials.

The assurance factor is in the quite satisfied category. Some lecturers stated that the quality of the tools/materials that will be used by lecturers is difficult to know because there is no record of damage to the tools/materials. According to students, the manager can build a sense of security and comfort for users so that users can work comfortably without worrying about losing items.

The empathy factor is in the very satisfied category. The majority of lecturers stated that they felt helped by the laboratory assistant when a work accident occurred, and also when the lecturer experienced difficulties because the lecturer felt that the laboratory assistant was responsive in following up on the lecturer's complaints. In addition, the laboratory assistant always cares about every problem faced by students. The laboratory assistant's understanding of the needs and desires of students is considered good, even though the laboratory assistant has sufficient ability to process and present information.

The tangible factor is in the very satisfied category. This factor is a factor that can be observed directly by laboratory users. Several lecturers stated that they were aware of the laboratory usage schedule because the laboratory usage schedule only contains the practicum schedule and not the overall laboratory usage schedule and is also placed in the laboratory. In addition, lecturers stated that they could use/borrow tools/materials in the laboratory easily because the storage of the tools was still not neat. However, lecturers showed a positive response to the arrangement of tables and chairs, the arrangement of air conditioning and lighting in the laboratory, but the majority of lecturers showed that they were comfortable working in the laboratory because the laboratory was considered not spacious enough.

Physics laboratory planning showed very good results with several areas that need improvement. Administration, arrangement and storage, occupational safety, maintenance, and monitoring and evaluation all have room for improvement even though they are already in the good category. By focusing on improving the aspects mentioned, the physics laboratory can continue to develop and provide better facilities for users.

The performance of lecturers and students in the physics laboratory was quite good, with several aspects that were very good especially among students. Lecturers showed good knowledge and skills, but need to improve their role and motivation in following administrative procedures. Students showed very good closeness, togetherness, team structure, roles, and norms, showing high coordination and discipline. Continuous improvement in both groups will help improve the efficiency and effectiveness of physics laboratory management.

The satisfaction of basic physics laboratory users showed varying results with several factors that need improvement, namely (1) reliability; Needs improvement especially in the provision and placement of SOPs and labeling of tools/materials; (2) responsiveness, laboratory assistants need to be more responsive to problems faced by students; (3) assurance: There needs to be a record of damage to equipment/materials to make it easier for lecturers and students to know the quality of the equipment/materials, (4) empathy: It is very good, but still needs to be maintained, (5) tangibles: The arrangement and storage of equipment needs to be tidier, and the laboratory needs to be expanded to improve comfort.

The results of this study are in line with Nurhayati's research which states that there are two aspects with a very low positive response category, namely the practical procedures and the availability of equipment and materials (18). In addition, the results of this study are also in accordance with the results of La Ode Wero's research which states that Public Satisfaction with services in the integrated laboratory of the Physics unit is in the Very Good category, which means that in general students are satisfied with the elements of service provided by the Integrated Laboratory of the Physics Unit (UHO) (19). In Cindy Sagita's research which states that student information in the science school concentration study program about equipment and how research facilities work is quite adequate and needs to be improved, (2) The impact of the closed survey given to students is (a) the interest in practical exercises states that they agree and agree; (b) the condition of the lab stated that they agreed and agreed that it should be improved, (c) the implementation of the practicum and the basis for the implementation of the practicum 100 percent of students stated that it was good (20). Zahra her research stated that there is a significant positive relationship between perceptions of service quality and consumer satisfaction together with consumer loyalty, the higher the perception of service quality and consumer satisfaction, the higher the level of consumer loyalty (21).

CONCLUSION

In this study, several conclusions were obtained regarding the management of basic physics laboratories and their influence on performance and user satisfaction at Universitas Muhammadiyah Prof. DR HAMKA.

Overall laboratory management is in the good category with several very good aspects such as operational planning and lab facilities. However, several aspects such as work safety and maintenance still need to be improved and the lack of periodic maintenance planning and inadequate facilities, such as the absence of demonstration tables and special storage rooms, reduce the efficiency of laboratory use.

The performance of lecturer and student users in using the basic physics laboratory is generally in the very good category. Lecturers show good knowledge and motivation in using the laboratory, while students show good teamwork and norms during practicums. Laboratory managers need to improve their roles and skills in assisting users, because several aspects are still in the fairly good category.

User satisfaction, both lecturers and students, with laboratory services is in the category of quite satisfied to very satisfied. Empathy and tangible factors get very good ratings from users. Several aspects such as reliability and responsiveness still need to be improved to achieve higher user satisfaction.

The results of this study indicate that although the management of the basic physics laboratory at Universitas Muhammadiyah Prof. DR HAMKA is generally good, there are still several aspects that need to be improved to improve overall performance and user satisfaction. Improvements in maintenance planning, additional facilities, and improving the skills and roles of laboratory managers will greatly support the improvement of the quality of education at the university.

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