



The Effectiveness of Science Laboratory Management at Junior High School

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Received: January 2022; Revised: May 2023; Published: July 2023

Abstract

The laboratory is a place to conduct experiments to prove the theories given in class. This research was conducted to look at the effectiveness of management and constraints of managing a science laboratory at the junior high school (SMP) level. This research used a survey research method with a quantitative approach, while the research subjects were the Head of Laboratory Assistants from 4 junior high schools in Riau province, namely SMPN 1, SMPN 3 Kuok sub-district, SMPN 8, and SMPN 43 Pekanbaru. The data was collected by distributing a questionnaire on the effectiveness of management and use of the laboratory which was given to the head of the laboratory with as many as 117 questions. The research results obtained were the level of effectiveness of science laboratory management in the two regions, namely SMPN Kampar Regency obtained an overall average score of 87.4% while SMPN in Pekanbaru received an average result of 49.82%. Overall, the results were obtained by very good category standard value A. However, in reality there are still several problems in laboratory management, resulting in constraints on several indicators such as completeness of tools, and provision of tools and materials and the main problems occur in organizational and administrative indicators with an overall average result of 49, 82% are below the expected standard with a bad category. So it is necessary to re-evaluate and improve administrative and organizational management which is often neglected by school laboratory management so that special attention can be given to further improvements to obtain very good effective results in the future

Keywords: Management Effectiveness Lab, Constraint Management Lab, Science Laboratory

How to Cite: Arrahma, A., Afiqah, N., Erlinawati, E., Randa, G., Linda, R., & Rahmad, M. (2023). The Effectiveness of Science Laboratory Management at Junior High School. *Prisma Sains : Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, 11(3), 660-671. doi:<https://doi.org/10.33394/j-ps.v11i3.6901>

 <https://doi.org/10.33394/j-ps.v11i3.6901>

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INTRODUCTION

Learning in the 21st century can be interpreted as learning that teaches 4C to students, namely: Communication, Collaboration, Critical Thinking and Creativity (Muhali, 2019; Muhali et al., 2020; Nahdiyaturrahmah et al., 2020; Sabri et al., 2022). IPA is a branch of science that studies natural phenomena (Muhali, Asy'ari, et al., 2021; Wahidah et al., 2021). According to Najema, (2020) Natural Science is a basic science that provides many provisions to students in everyday life. The science learning process in general has several criteria that must be met, these criteria include process, product, and attitude aspects (Malik et al., 2020; Muhali, Prahani, et al., 2021).

Science learning is not only limited to theoretical knowledge, concrete concepts, facts or principles, but students also need learning that emphasizes the direct experience (Ismiyanti et al., 2021; Verawati et al., 2022). One of the skills that must be possessed by a science teacher is the ability to manage school laboratories (Rosidin et al., 2020). According to Musdalifa & Faridah, (2021) The laboratory is a place for experiments, scientific research, measurements

or scientific training, according to Susilo & Amirullah, (2018) The laboratory is one of the supporting facilities and infrastructure for teaching and learning activities in schools.

Laboratory education is essential in the learning process because it provides opportunities for students to practice intellectual abilities through observation activities, noting natural phenomena, and developing students' motor skills (Nahdiyaturrahmah et al., 2020). In line with Pertiwi, (2019) that laboratory activities must be able to cultivate several skills, namely process skills (observing, measuring, and manipulating physical objects), analytical skills (reasoning, deductive thinking, and critical thinking), communication skills (ability to organize information and write reports), and conceptualization of scientific phenomena.

Low utilization of science laboratories in schools as a means of supporting the learning process is one of the inhibiting factors in improving the ability or skills of students. By carrying out the learning process that utilizes the laboratory, students are expected to be able to master the subject matter, not only through theory but also through practice. The existence of science laboratories in schools is very important in the learning process teaching due to the many learning facilities or media that are not available in the classroom and are only available in the science laboratory (Mukti & Arikunto, 2020).

Research conducted by Adilah et al., (2021) stated the obstacles encountered in carrying out the practicum, including a large number of damaged equipment, expired materials, there were tools available but not used properly, and also there was no specific schedule regarding the implementation of the practicum while the results of research by Marcella et al., (2018) at SMP Negeri 17 Jambi City and SMP Negeri 19 in Jambi City Teachers are still not motivated to carry out practicum, because the facilities and infrastructure in the physics laboratory are not complete, the laboratory is used as a classroom, so to do practicum the tools must be brought to class so that the available time is not effective.

The constraints described above indicate the need for laboratory management and management of laboratories in schools according to Permendiknas standards number 24 of 2007. Minimum science laboratory space can accommodate one group (one class) with \pm 20 students. The science laboratory has at least practice space, storage and preparation space. Facilities that should be available at least have adequate light in the room to read and make observations on experimental objects, and there is clean water.

Laboratory Management is an effort to manage the Laboratory based on standard management concepts (Putra et al., 2018). According to Ismiyanti et al, (2021) Laboratory management will be better if carried out before the laboratory is used as a learning resource by students. In carrying out laboratory management it is necessary to meet the criteria for planning, organizing, implementing, monitoring and evaluating.

The results of research conducted by Yolanda et al., (2019) at SMP Negeri 6 Pekanbaru City The science laboratory planning has not been carried out optimally due to the lack of adequate facilities and the implementation of the science laboratory planning is still not well structured, whereas according to Desti & Maryanti, (2019) it shows that the average percentage of completeness of tools and materials for the state junior high school science laboratory in the city of Pekanbaru is 85.43% (including the good category) and the description of the science laboratory is in accordance with Permendiknas No. 24 of 2007 concerning facilities and science laboratory infrastructure for junior high schools.

When using the laboratory and performing any activity With it, you can run effectively in your lab. Lab management involves staff and users management. management of laboratories such as Other lab buildings, equipment and funding Materials that require personal control and that allow users to: Maintain and improve functional continuity Teacher skills in the laboratory management process According to his Permendiknas No. 26 of 2008: Laboratory management standards in Schools (Suseno et al., 2022; Wahidah et al., 2021).

On Evana et al., (2021) research that management planning science laboratory is well done, due to the coordination between the school principal, the head of the laboratory, and science teachers in determining the vision, mission, and objectives as well as the science

laboratory budget at the beginning of the school year. Then implementation of the plan for science laboratory activities is arranged and scheduled for the use of the laboratory, in annual and semester programs.

According to Nugroho et al., (2022) the intensity of utilization of the junior high school science laboratory in Siak district is in the high category. This is due to good cooperation between the head of the laboratory and the subject teacher in managing strategies to provide easy access to the use of science laboratory equipment and rooms in schools.

Based on the description above, with various forms of science laboratory problems, researchers are interested in researching to measure the level of effectiveness in the use and management of laboratories in several junior high schools in Kampar and Pekanbaru districts so that they can determine the level of effectiveness of laboratory use according to teachers and students. The title of this research is Management Effectiveness and Constraints of Management of Science Laboratories in Junior High Schools to see whether laboratory management and management effectiveness meet the standards of Permendiknas No.24 of 2007 and Permendiknas No.26 of 2008.

METHOD

This research was conducted at SMP Negeri 1, SMP Negeri 3 Kuok and SMP Negeri 8, SMP Negeri 48 Pekanbaru. This research is a survey research with a quantitative approach with a spread questionnaire And interview. Questionnaires were given to 4 laboratory assistants and 20 students from each school to obtain data on the effectiveness of using the laboratory at school. The questionnaire used amounted to 117 for the assistant laboratory and 60 questions for students with the same indicator. Obstacles found were obtained through direct interviews with the head of the laboratory regarding any problems that became obstacles during the implementation of laboratory management And the response from students as participants in the activity laboratory. The results of laboratory effectiveness data collection were then analyzed descriptively quantitatively, while the results of constraints were obtained from effectiveness indicator scores that were low or in the not-good category and analyzed qualitatively. The effectiveness of instrument laboratories based on PERMENDIKNAS standards No. 24 of 2007 and No. 26 of 2008 adapted from: (Meita, 2018; Munarti & Sutjihati, 2018) can be seen in Table 1.

Table 1. Laboratory effectiveness indicators

No	Variable	Number of Questions
1	Location and laboratory space	8
2	Laboratory equipment and materials	41
3	Storage of laboratory equipment and materials	5
4	Laboratory equipment	13
5	Maintenance of laboratory equipment	7
6	Laboratory utilization	6
7	Laboratory organization and administration	18
8	Provision and preparation of tools and materials to be used for practicum	9
9	Laboratory Work Safety	5
10	Cleanliness of Room and Laboratory Furniture	5
Total Questions		117

Source : (Meita, 2018; Munarti & Sutjihati, 2018)

The data obtained is in the form of survey results and questionnaire scores. The data obtained will be analyzed using the following formula (Rajagukguk, 2022):

$$P = \frac{f}{n} \times 100 \% \tag{1}$$

Information:

P = The percentage value of the respondent's answers

f = frequency of respondents' answers

n = Number of respondents

The descriptive analysis conducted by the researcher on the effectiveness of science laboratories in schools was guided by the percentage and rating scale criteria which can be seen in Table.2.

Table 2. Science laboratory effectiveness rating scale

No	Laboratory Effectiveness Interval (%)	Category	Laboratory Standard Value
1	81–100	Very good	A
2	61 - 80.99	Well	B
3	41 - 60.99	Not good	C
4	≤ 40	Not good	D

Source: adaptation (Satrio & Sabani, 2018)

RESULTS AND DISCUSSION

Results

The survey results obtained regarding the effectiveness of management and laboratory management at the junior high school level can be seen from the laboratory conditions and the implementation of practicums that take place at school. The questions given consist of 10 indicators. Data analysis was divided into two places or two regions, namely based on schools in the city of Pekanbaru and schools in the Kampar district, as a comparison between laboratory management in schools in the area and urban areas, while the data analysis was grouped with overall data from SMPN 1 Kuok and SMPN 3 Kuok as schools in Kampar Regency and SMPN 8 Pekanbaru and SMPN 43 Pekanbaru as schools in Pekanbaru City, the results of the data obtained are as shown in Figure 1 and Figure 2.

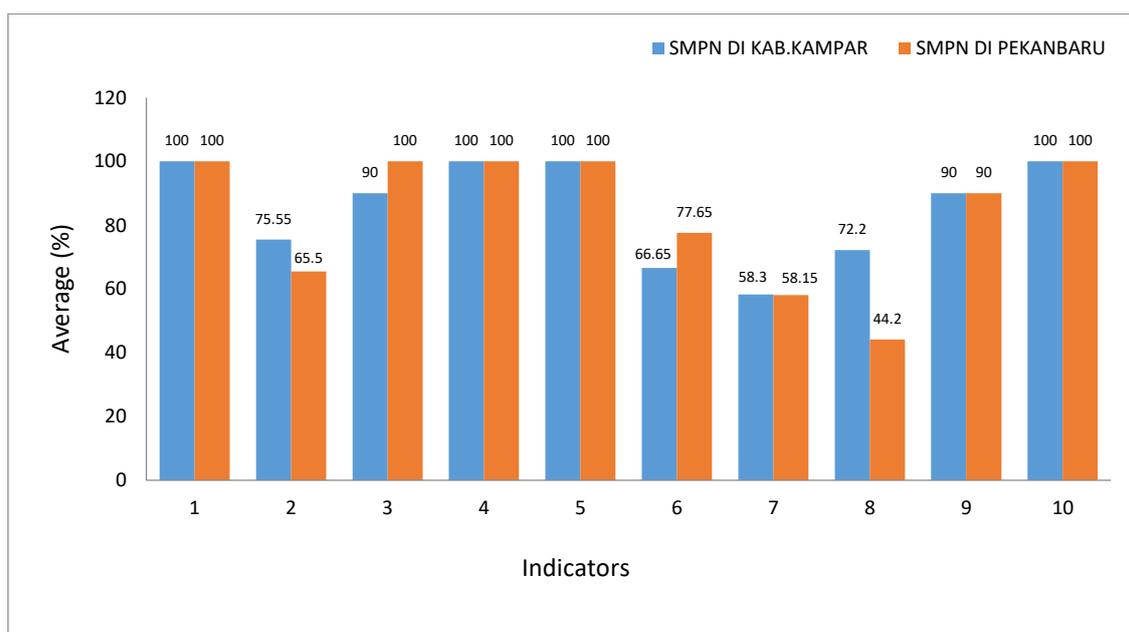


Figure 1. Data analysis of management effectiveness for each indicator.

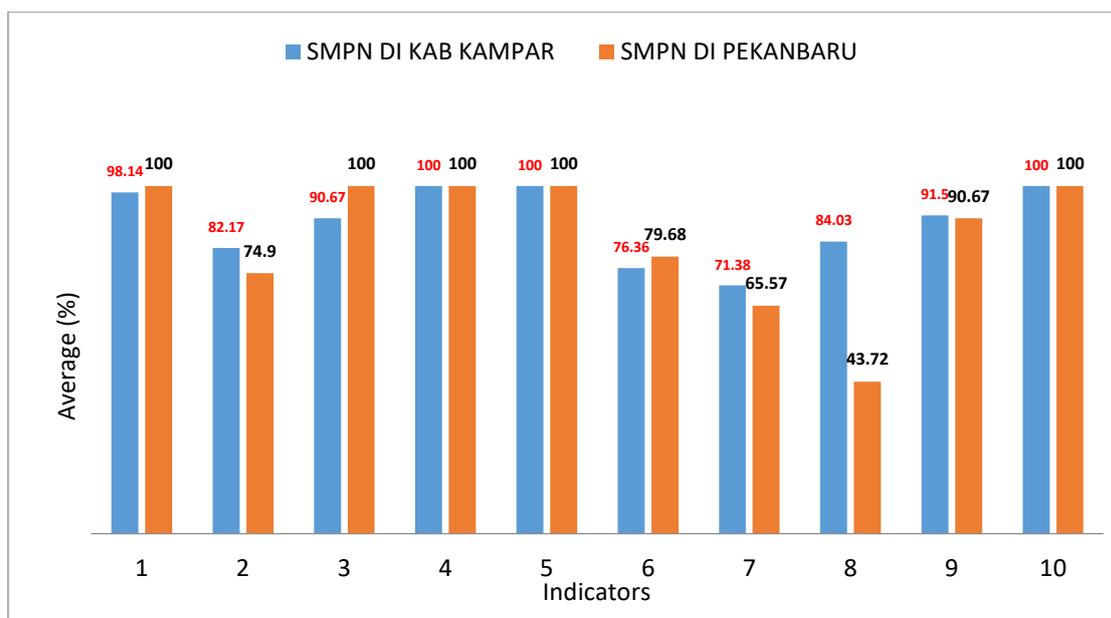


Figure 2. Results respondent student

Results obtained in a manner whole based on the Figures 1 and Figure 2 presented between effectiveness laboratories at SMPN Kampar Regency and SMPN in Pekanbaru each own relative score per indicator same. The average value of SMPN in Kampar Regency is 85.27% with the category very Good and at SMPN in Pekanbaru, the average value is 83.55% with the category very Good whereas For results response students ie 89.43% of SMPN in Kampar Regency and 85.45% of SMPN in Pekanbaru with category both of them very ok. So the results obtained in a manner whole show that in the management laboratory in both regions, the effect is in the category very Good with a score of A, meanwhile For constraint obtained an average score on indicator effectiveness included in the category low is on 3rd indicator. The 2nd, 7th, and 8th indicators can see in Figure 1 and Figure 2.

Discussion

Based on data that has been carried out at 4 junior high schools two schools in Kampar district and two schools in Pekanbaru City, the results of the analysis of several indicators are as follows: First, the teacher's response to the location indicators and laboratory rooms in Kampar district schools and Pekanbaru city gets a score the same average, namely 100% with a very good category, this result is by the research of Harefa et al (2021) that if the laboratory room has good conditions and is suitable for use so that the practicum process can run very well, then the location selection for these four schools is very easy to reach for students and teachers because of its strategic location making it easier for students to carry out practicums. As for student responses, the score of student respondents is very high with a school score in Kampar district of 98.14% and for schools in Pekanbaru city, the average score is very high at 100% according to Nurhadi (2018) if the facilities and infrastructure in a school are good then the learning process will also run smoothly. Without the existence of facilities and infrastructure that meet the minimum standard criteria, the facilities and infrastructure of a school cannot operate and are unable to carry out practical learning processes optimally.

The second is the teacher's response to the indicator for the completeness of laboratory equipment and materials where the average school in Kampar district is 75.55% in the good category and for the average school in Pekanbaru city it is 65.5% in the good category too, but the completeness of the equipment is wrong . one school in Pekanbaru and Kampar still has a shortage because the school is still relatively new, based on the results of a study by Trisianawati et al (2020) stated that the management of tools and materials is an activity that

will determine the success of laboratory management if in the laboratory there is a set of tools that are appropriate and sufficient for carrying out practicums for students, then there are no obstacles in the practicum process, but based on field facts there are several obstacles such as several incomplete laboratory tools and materials at SMPN 43 Pekanbaru and SMPN 3 Kuok. The laboratory conditions of the two schools can be seen in Figure 3:

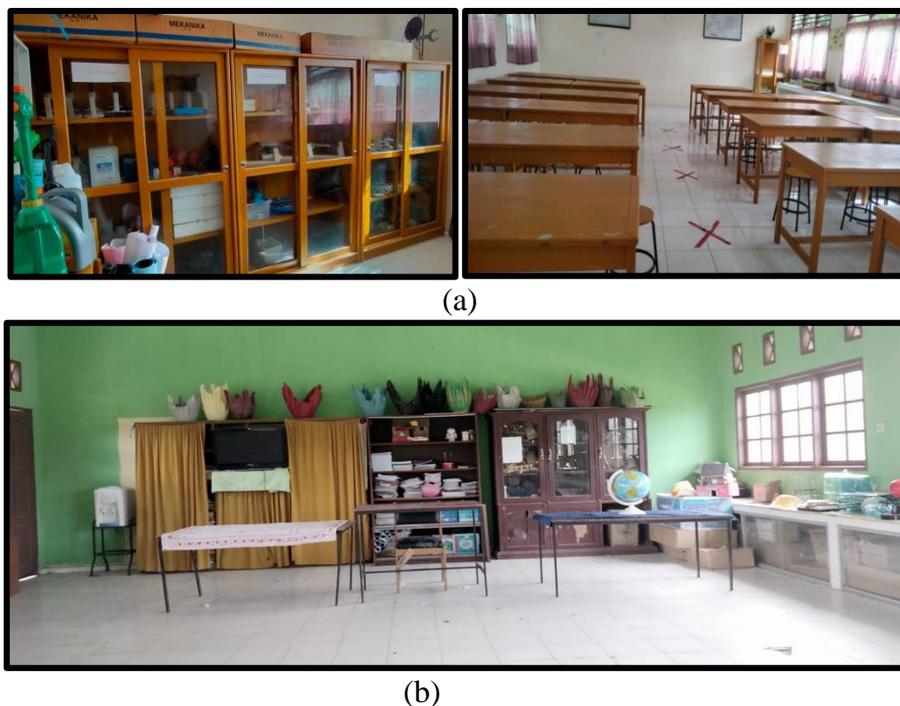


Figure 3. (a) Condition of equipment and material supplies and laboratory room of SMPN 43 Pekanbaru (b) Condition of laboratory room of SMPN 3 Kuok.

According to the Head of the Laboratory at SMPN 43 Pekanbaru, the use of the laboratory went well by utilizing the limitations of existing tools, while SMP 3 Kuok also experienced problems with the completeness of tools and materials, because there were still many practicum tools not available and some tools with poor conditions were used. so that there are obstacles when conducting experiments in the laboratory.

As for student responses to the second indicator, the average score of schools in Kampar district is higher than the average score of schools in Pekanbaru city, the score in Kampar district is 82.17% and the average score of schools in Pekanbaru city is 74. 9%, in line with research by Sari et al (2018) which states that the laboratory requires a set of tools to support teaching and learning activities, these supporting tools are related to good practicum tools and materials for carrying out practicum in the laboratory to run effectively for students.

The third indicator is seen from the teacher's responses, namely the average storage of laboratory equipment and materials in Kampar district 100% in the very good category then the average for schools in Pekanbaru city 90% in the very good category can be seen in terms of storage of laboratory equipment and materials has very good criteria so that the practicum process can run well, this is also by Harahap et al (2022) if the storage of laboratory equipment and materials is not stored by the place, then the practicum process can be disrupted and can reduce student concentration during the practicum process due to tools - the tool is not used according to its function. Whereas for student responses the average score for schools in Kampar district is 90.67 % and the average score in Pekanbaru city is very high at 100% in line with the very category with research by Suhali et al (2022) if a school does not prepare tools and materials before practicum by laboratory assistant, the effectiveness in the learning process will be disrupted, but if you look at schools in Kampar district and Pekanbaru city, it can be said that the learning process is going well.

Fourth, the laboratory equipment indicator section is seen from the teacher's responses where the average school in Kampar district and Pekanbaru city is 100% in the very good category, so the average for all schools that have conducted research can be seen in terms of very good laboratory equipment. Based on the results of a study from Karlina (2022) states that if a school has complete laboratories, the practicum process will run effectively because the aspect of laboratory completeness is an aspect that supports practicum activities. As for student responses, the average score for schools in the Kampar district is 100% in the very good category, while the average school in Pekanbaru city is 100% in the very good category. research by Hastiana et al (2023) that the completeness of tools and materials in the laboratory is a very important support because every student gets the opportunity to use laboratory practicum equipment that is appropriate for the learning process.

The five indicators of maintaining laboratory equipment are seen in the teacher's response. Schools in Kampar district have a very good percentage of 100% and schools in Pekanbaru city also have a very good percentage of 100%. Meanwhile, for student responses to this fifth indicator, schools in Kampar district have a percentage of 100% in the good category, and schools in Pekanbaru city have an average score of 100%. Student responses can be categorized as very good, which can be said in practical implementation accidents rarely occur and opportunities for equipment damage and the materials are very small when viewed from the percentage of the two schools, the indicators for maintaining laboratory equipment support the practicum process effectively and can run smoothly according to Handayani et al. (2022) states that maintenance of laboratory equipment is an effort to find out opportunities for damage to laboratory equipment so that it can prevent potential hazards that can result in injury to humans and the environment so if laboratory maintenance is optimal, the practicum process will run very well.

The teacher's response to the sixth indicator, namely laboratory utilization in Kampar district has a percentage of 66.65% in the good category and for schools in Pekanbaru city it has a percentage of 77.65% in the good category, laboratory utilization is good because the teacher also carries out some practicum in the laboratory, but there is the problem found is that the use of the laboratory has not been optimally utilized due to a shortage of hours for practicum and incomplete tools and materials so that most students only study in class instead of carrying out practicums so that the cognitive and psychomotor abilities of students in the learning process also decrease, in line with Rafiqah et al (2022) stated that what resulted from the laboratory utilization indicator was that it made students more motivated and excited to learn science and increased students' cognitive understanding of concepts previously learned in class. Meanwhile, for student responses in Kampar district, it has a percentage of 76.36 % in the good category and for the average percentage score of schools in Pekanbaru city, it is 79.68% in the good category. Student responses to this indicator are good. There is a positive relationship if laboratory users can be optimized, research by Putri et al (2022) which states that there is a positive relationship between student learning outcomes and laboratory utilization.

The seven indicators of teacher response laboratory organization and administration in Kampar district have a percentage of 58.3% in the poor category and schools in Pekanbaru city have a percentage of 58.15% in the poor category. lessons that double as laboratory assistants so that in carrying out practicums it is good but less effective depending on subject teachers instead of relying on laboratory staff, so the problem found and being an obstacle in 4 schools is that the head of the laboratory always thinks that organization and administration do not need additional staff such as laboratory assistants and technicians who help manage the laboratory because the head of the laboratory and the teachers concerned are enough, this is in line with Susilo & Amirullah (2018) stated that the existence of laboratory assistants is very important because it is a component of the development and even decline of a laboratory. While the response of students in Kampar district has a percentage of 71.38% in the good category and the average score of schools in Pekanbaru city of 65.57% in the fairly good category, this student response shows that in Kampar district it is better than the average score on average in

the city of Pekanbaru this indicator is one of the important indicators of effectiveness in laboratory management, in laboratory management an organizational structure is needed such as the head of the laboratory, laboratory assistants, and technicians in line with research by Silvia & Aryanti (2022) organizational indicators are used to measure organizational functions not working as they should if the people in the organization do not carry out their duties and functions properly.

Regarding the eight indicators for the provision and preparation of tools and materials to be used for practicum, the response of teachers in Kampar district has a percentage of 72.2% in the good category, and for the percentage of schools in Pekanbaru city 44.2% in the category of unfavorable this from the percentage it seems that there is little the difference between schools in Kampar district and schools in Pekanbaru city is due to the lack of available teachers in Pekanbaru City when conducting practicums in providing and preparing tools and materials. As for the student response in Kampar district, it has an average score of 84.03%, while the average percentage score in Pekanbaru city is much lower than schools in Kampar district, namely with an average score of 43.72% in the unfavorable category. in laboratory management, this is very important because it is one of the factors in the success of the practicum process carried out by students and teachers in line with research by Harahap et al (2022) that this indicator is very important function is to direct students in practicum activities. So that it must be maximized which will have an impact on achieving student competence in learning science. The obstacles that occur in schools in the city of Pekanbaru are at SMPN 43 Pekanbaru with the provision of tools that are still lacking because they tend to carry out practicums only using existing tools and materials, easy to find and use

The nine indicators of teacher response laboratory work safety in Kampar district have a percentage of 90% in the very good category and the percentage of schools in Pekanbaru said 100% with a very good category of the four schools that in the indicator of laboratory work safety there is a very high awareness of work safety so that the risks can harm both students and teachers can be prevented in line with Wicaksana (2022) laboratory work safety are conditions and factors that can have an impact on the safety of students and teachers. Scientific work safety is a pattern of thinking and its application to minimize the occurrence of accidents or work-related illnesses. Occupational accidents can be interpreted as an activity that can cause a hazard while working and can have an impact on humans, property, and processes. This concept is expected to minimize the occurrence of a work accident when using a science laboratory, to reduce the risks that can endanger the laboratory environment and practitioners. Accidents can be broadly interpreted as unexpected events. While the response of students in Kampar district average score was 91.7 % with a very good category for schools in Pekanbaru City had an average score of 90.67% with a very good category seen from the students' positive responses in answering the questionnaire questions in line with the statements. This is in line with the research of Nadillah et al (2022) that to reduce work accidents a laboratory assistant takes part in training aimed at increasing students' knowledge to reduce the risk of work accidents because the safety of every laboratory user is the responsibility of every laboratory officer and user.

In the assessment of laboratory work safety and cleanliness of laboratory space and furniture, teacher responses at Kampar and Pekanbaru Middle Schools both scored 90% for laboratory work safety and 100 for the cleanliness of laboratory space and furniture. At the Laboratory Effectiveness Interval, the values are 90% and 100%, which get a very good Meita (2018) revealed in their journal entitled Standardization of the Science Laboratory of SMPN 3 Sumenep regarding laboratory facilities and infrastructure, work safety and cleanliness of laboratory rooms and furniture, including important things, this is in line with standardization or SOP from Prmendiknas no 24 of 2007. The tenth indicator is student response. Kampar district has an average score of 100% in the good category for schools in Pekanbaru city has an average score of 100% in the good category, it can be said that the results of student responses in the learning process are very good for work safety issues then cleanliness of the

room so students being comfortable and concentrating in the practicum process is in line with the research of Trasmini et al (2021) that laboratory cleanliness is important for work safety, such as floors that must be kept somewhat parallel so as not to cause bigger accidents. The location of cabinets in the laboratory must also be neatly located outside the room to make it easier for students and teachers to move around.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that there are 10 indicators to determine the management and management of science laboratories in junior high schools with the results of effectiveness obtained by the two regions, namely SMPN in Kampar Regency obtaining a score 85.27% with very good category and SMPN in Pekanbaru obtained a score of 83.55% with a very good category while the student response results were 89.43% SMPN in Kampar Regency and 85.45% at SMPN in Pekanbaru with both very good categories as well, in terms of laboratory management in the two areas, very good effectiveness results were obtained with a standard value of A, but in fact, there were still several problems in the field that led to constraints on several indicators such as the completeness of tools, provision of tools and materials as well as the main problems occur in organizational and administrative indicators with the average results obtained below the expected standard in the unfavorable category. So it is necessary to evaluate and improve administrative and organizational management which is often overlooked by school laboratory management so that it can be further improved and given special attention for further improvements.

RECOMMENDATION

Recommendations for future researchers to be able to expand the study studied regarding Student Perceptions of Practicum Implementation in Middle School Science Laboratories so that it can be known what factors can influence the implementation of practicum in Middle School Science laboratories in accordance with Standard Operating Procedures (SOP) implementation in the laboratory. for future researchers to be able to compose questions using sentences that can indirectly trigger students to answer honestly.

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