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# Optimization of Management of Laboratory Facilities in the Process of Learning Science at High School

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Abstract: Carrying out learning in the laboratory in the form of a practicum is one of the science learning techniques that can establish the circumstances for accomplishing the results of science scientific concepts and components of science science processes. The objectives of this study are to: ascertain the state of the science laboratory in high school. The others objectives area to ascertain the implementation of science practicum activities in the and to ascertain the challenges encountered and solutions for resolving these challenges in high school. This study came to a few conclusions: the management of science laboratories in high schools is not good because there are still many activities in the planning program that have not been carried out in accordance with the plan. Planning, which includes the preparation of a work program, is planned one month before the start of the school year and made at the start of the school year, Organization, which includes organizational structure and administration, has not been implemented properly, such as there being no updates to the laboratory organizational structure, which means that students also do not know who is managing the laboratory, Implementation of practicum activities is rarely carried out in the laboratory due to limited tools and materials, Supervision and evaluation, namely by supervising internal schools and having supervisors come from the government, Factors that contribute to the management of this laboratory are laboratory assistants, students, time, and limited equipment and materials

Keywords: High school; Laboratorium; Science

## Introduction

One of the resources for raising the quality of education is educational facilities. Supporting learning activities is crucial, particularly in the implementation of the learning process in schools (Azhar, 2016). Purnawan (2009) claims that quality enhancement. The quality of instructors in Indonesia is partly dependent on the infrastructure and facilities available for education. In science learning to apply the scientific method, a laboratory is needed as a facility or place to carry out practicum activities. Utilization of laboratories or practical activities is part of the teaching and learning process. Through practical activities, students can prove existing concepts or theories and can experience the process or experiment themselves, then draw conclusions, so that they can support students' understanding of the lecture material. In this case, if students understand more about the lecture material, it is hoped that their learning outcomes can increase.

One of the science learning methods that can create conditions for achieving the results of science scientific concepts and components of science science processes is to carry out learning in the laboratory in the form of practicum. Practical activities are activities carried out to discover a new concept for students which is based on existing concepts or principles formulated by experts. When viewed from a student perspective, this practicum

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activity is an activity to discover concepts or principles, and when viewed from an expert perspective, this activity is a concept or principle verification process. This practicum itself is a learning method that can develop students' curiosity, activity, creativity, innovation and scientific honesty in dealing with problems in the realities of life.

Researchers found that the coordination of practicum activities with the Science Laboratory had not yet developed the best management synergy during the implementation of practicums at the Science Laboratory. This is demonstrated by the lack of a departmental policy that would support the laboratory policy governing the implementation of practicum activities for students in the science laboratory.

The results of preliminary observations on the management of practicum in high school laboratories show that practicum activities are carried out in accordance with the presentation of lessons in semesters, which are carried out by several teachers without the assistance of high school The results of preliminary observations on the management of practicum in high school laboratories show that practicum activities are carried out in accordance with the presentation of lessons in semesters, which are carried out by several teachers without the assistance of high school students' assistants. However, in its application, it is known that there is still practical material that is not yet in sync with the theoretical material presented in college; often, practical material is faster than theoretical material in class. This has an impact on the shallow mastery of theoretical material by practitioners. Apart from this, various teaching aids are still found that require regeneration due to age but are still used for practical activities. The science laboratory room is still joined by the mathematics and social sciences laboratories. We can assume that the education gap in Indonesia is that the learning process in Indonesia still emphasizes increasing knowledge (aspects of cognition), one of which is the tendency to memorize more.

This is evidenced by the results of research related to "Management of Science Learning in terms of the Nature of Science" conducted by Ali et al. (2013) in East Lombok District at the junior high school level concluded that teachers have a poor understanding of the nature of science, the teacher very rarely applies the nature of science in learning, the teacher's obstacles occur in the incompatibility of the material with the allocation of time, the orientation of aspects of cognition, the initial mental readiness of students, and the teacher's lack of understanding of the nature of science, and teacher is more dominant in using the discussion method and lectures in managing learning.

Science learning will be even better if there is laboratory space. Providing laboratory space is very important in schools to carry out practical activities. Facilities and infrastructure that are already available in the laboratory really need a good management technique so that the laboratory can be used in the long term. In the world of education, the laboratory functions as a place to practice developing intellectual skills through observing activities, recording natural phenomena and developing students' motor skills. It is from this activity that later students will add to their skills in using the available tools to seek and find the truth, provide and cultivate the courage to seek the nature of scientific truth from an object in the natural and social environment, a place to train students to be careful, patient, honest, think critically (Herawati, 2016; Sutrisno, 2016), and be agile.

The laboratory is used as a learning resource; it will be better if it is managed first before it is used by its users. The existence of good management can help facilitate teachers and students use of the laboratory. Management is the process of utilizing human resources effectively and efficiently in the management of a science laboratory to achieve the expected targets optimally by paying attention to the sustainability of the function of human resources themselves. Effective laboratory management must meet the criteria for planning, organizing, implementing, monitoring, and evaluating.

Obstacles in implementing biology practicum were found, namely: laboratory facilities were incomplete, a lot of equipment was damaged, materials were out of date, the laboratory was also used for activities other than practicum and there were tools and materials available but never used as intended; support schools for practical activities are still morally supported and funding support in collaboration with the school committee is still not sufficient to meet the needs for carrying out practicums, so that teachers and students often independently bring the necessary materials themselves; the management of the biology laboratory is assigned to one of the biology teachers and there is no schools that have laboratory assistants and laboratory technicians, laboratory managers never take part in laboratory management training and similar activities; At the implementation stage, student mobility is quite high in practical activities, requiring more attention from teachers; there is no special schedule for practical activities; students difficulties in carrying out practicums are that they do not master the concepts being practiced; they are less skilled in using practicum tools because they are not used to them; they have difficulty working together in groups; and they are less interested in making practicum reports.

One of the standards for facilities and infrastructure developed by BNSP and stipulated by ministerial regulations is standards for the diversity of types of natural science (IPA) laboratory equipment, language 8227 laboratories, computer laboratories, and other equipment in educational units stated in a list containing the minimum types of equipment required must be available (Mulyasa, 2013). This cannot be separated from that. According to Eka (2012), physics is a science that is born and develops based on observations and experiments conducted in the laboratory. So it can be said that the existence of a laboratory with physics subjects is an inseparable part.

Azhar (2008) argues that in learning physics, it should be supported by laboratory facilities so that students can understand physics more effectively and not bore themselves. Furthermore, Nuada (2015) adds that through practicum activities, students will do scientific work so that they can develop the ability to find problems, find alternative solutions to problems, create hypotheses, design research or experiments, control variables, make measurements, organize and interpret data, make conclusions, and communicate the results of research both orally and in writing.

Practicum activities carried out in the laboratory are methods that influence student success in learning. Students can learn by directly observing processes, train scientific thinking skills, instill and develop a scientific attitude, discover and solve various existing problems through scientific methods, and so on (Rahmiyati, 2008). The word laboratory comes from Latin, which means "place of work". In its development, the laboratory maintain its original meaning, namely "place of work," specifically for the purposes of scientific research. A laboratory is a room where practical or research activities are carried out and are supported by a set of tools and complete laboratory infrastructure (water, electricity, gas, and so on) (Sumintono et al., 2010). In addition, according to Mastika et al. (2014), a laboratory is a place where experiments and research activities are carried out. This place can be a closed room or an open space.

Laboratories need to be maintained and managed because they play a role in encouraging the effectiveness and optimization of the learning process through carrying out various functions, which include service functions, learning media procurement and development functions, research and development functions, and other functions that are relevant to increasing the effectiveness and efficiency of learning (Syaifulloh et al., 2014).

According to Lubis (1997), Sundari (2008), and Hartinawati (2010) the function of the laboratory is as a place where practical science learning takes place, which requires special equipment that is not easily available in the classroom. Meanwhile, according to Kertiasa (2006), the function of school laboratories in science learning depends on the teacher's views on science and learning. Regarding science, there are those who see it only as a collection of knowledge about nature that has been collected and arranged systematically. Another view is that science is not only a collection of knowledge but also the knowledge obtained and developed, as well as the attitudes that need to be adopted when developing it.

According to Lazarowitz and Tamir in Astuti (2010), there are five factors that can facilitate the success of science laboratory teaching: curriculum, resources, learning environment, teaching effectiveness, and assessment strategies. In order to maximize laboratory management, the tasks that must be carried out by the laboratory assistant are: planning the procurement of tools and materials; compiling activity schedules and procedures; preparing tools and materials; managing the expenditure and entry of equipment storage; registering the use of tools and materials; making catalog lists; inventorying and administering the use of tools and materials; maintaining and repairing damaged equipment or tools and materials; inventorying student or research participant data; and compiling reports on the implementation of laboratory activities (Decaprio, 2013). In this instance, the laboratory and the study of physics go hand in hand. However, due to a variety of factors, including insufficient time for practicum, inadequate equipment, a lack of laboratory assistants, and other issues, practicum activities are occasionally infrequently carried out.

The functions of the science laboratory room include, among others, as a place for learning science and providing skills, a place to make new friends, both theories and new tools and skills, a place for display or exhibition, place to practice and prove whether or not (verify) certain symptom factors, place for practical Biology learning activities that require special equipment.

The science laboratory standards set include: laboratory space design, laboratory administration, laboratory management, and storage of science practicum equipment and materials. The size of the laboratory room must be appropriate to the number of students in one class. The practice room has a length of 11 m and 9 m wide, while the ceiling height is 3 m. Minimum wiggle ratio students in the science laboratory room 2.4 m<sup>2</sup>/student. So it is estimated that the practice room has an area of 124 m<sup>2</sup>, including the preparation room and storage room. This area is based on the calculation that the laboratory is used by 40 students.

Laboratory administration is defined as a recording or inventory of laboratory facilities so that the type and quantity of each type can be identified precisely. Aspects that need to be administered include laboratory space, laboratory facilities, practical equipment and materials as well as laboratory activities. Laboratory administration referred to in this research is a process of recording or inventorying laboratory facilities and 8228 activities. Administration is carried out so that all laboratory facilities and activities can be organized systematically. According to Rumbinah (2016), correct administration will be very helpful in planning the procurement of equipment or materials, controlling the efficiency of budget use, expediting the implementation of practical activities, presenting reports objectively, facilitating supervision and protection of laboratory assets considering that laboratory assets are a government investment in the education sector.

Management is a joint responsibility of both managers and users. Laboratory management is broadly differentiated as follows: maintaining the smooth use of the laboratory, Providing the tools and substances needed in the laboratory, Provision of substances for students consists of two kinds, namely substances that can be taken directly and substances that must be requested from laboratory staff and increasing the usability of the laboratory. The role of the Science Laboratory laboratory assistant is to assist the Study Program Coordinator and Person in Lecturer Managing the Science Laboratory in the following activities: Planning the condition of the science laboratory equipment, Assisting and preparing a schedule for the utilization of the Science Laboratory, Developing a laboratory activity program, Organizing cleaning, maintaining, repairing and storing chemical materials, practicum reports, inventorying science and administering science laboratory equipment; and compiling reports on the utilization of science laboratories.

The task of the person in charge of the laboratory, apart from coordinating various other aspects, is also to arrange the scheduling of laboratory use. This scheduling is coordinated with the study program department and considers lecturers' suggestions so that the process of using the laboratory runs optimally. The laboratory is equipped with a variety of tools. It is best to store tools that are often used, portable for practitioners, expensive, or unusual away from other items. A specific storage facility should be established to house the instruments used in certain sorts of investigations. For instance, a microscope is often kept in a bright, dry area to preserve the quality of its lens function. Science experiment materials are often stored depending on the experiment title or the tool's primary materials.

Storage of tools made of plastic, glass, metal, and rubber such as a measuring cup, a test tube, and so on, respectively.grouped together and stored according to their respective groups. the type so that the practitioner can find it more easily. Tools made from glass should also be separated from electric tools and plastic tools. Heavy equipment is placed in an easily accessible place, and expensive or dangerous equipment is stored in a locked place. Basically, equipment storage should not be placed in a place that could cause the device to be damaged or in a place where the process of taking or returning it could endanger the user.

Likewise with laboratory equipment, there are relatively many chemicals in the laboratory. Chemicals can pose a fairly high risk of danger, therefore in laboratory management aspects of storing, organizing and maintaining chemicals are important parts that must be considered. The challenges that are frequently encountered in managing science labs are, according to Supriatna (2012), science laboratory facilities that are still considered inadequate are the condition of sinks, substance cupboards, fire extinguishers, first aid kits, and repair tools and so on.

Science laboratory administration equipment is generally seen as not meeting laboratory management standards. Standards that have not been met include planning, implementation arrangements, recording of tools and substances, and reporting. From the most technical aspect, it is considered inadequate, especially in terms of arranging tools and substances, using laboratory facilities, and maintaining and repairing damaged laboratory equipment. The components involved in laboratory management (study program coordinators, science lecturers and laboratory assistants) in carrying out their management activities are not based on clear management standards or guidelines and science laboratory management policies. In general, the management is left to the science teacher. There are also no laboratory assistants available in several laboratories, while their presence is urgently needed.

### Method

This type of research is descriptive and quantitative and measures the readiness and use of laboratories in high school. Descriptive research is a research method aimed at describing existing phenomena that are taking place now or in the past (Sugiyono, 2018). This study does not carry out data manipulation or make changes to the independent variables, but describes the condition as it is. Descriptive research is a form of quantitative research (Sukmadinata, 2013). This research illustrates the use of size, amount, or frequency. With a total number of student respondents of 100 students.

The sample used was taken using a simple random sampling technique, namely by taking members of the population at random without paying attention to the strata in the population. The population in this study is considered homogeneous. The procedures carried out are the research preparation stage, the research implementation stage, the data processing stage, and the conclusion-making stage. Data collection was carried out using questionnaires given to students, teachers, and laboratory assistants; laboratory observation sheets; interviews with teachers: and documentation studies to view laboratory administration.

The data analysis steps begin with instrument analysis using the validity and reliability of the instrument. Then, after collecting the data, it is analyzed using the percentage technique to calculate the readiness of facilities and infrastructure, the level of use, and the readiness of human resources, and using the product moment correlation for relationship analysis (Arikunto, 2011).



Figure 1. Descriptive research methodology

#### Respondent **High Schools** Important (%) Very important (%) Unimportant (%) Very unimportant (%) 76 Know the laboratory work program activities at 12 6 6 school The science teacher and the head of the laboratory 47 24 26 3 socialize the laboratory work program Knowing the organizational structure of science 71 5 18 6 laboratory managers in schools Knowing the duties of each member of the science 9 24 6 61 laboratory manager at the school The laboratory usage schedule is communicated to 25 12 19 44 students in each class Be aware of request for tool and material cards 47 12 35 15 Know the storage of laboratory equipment and 41 12 35 12 materials Carry out laboratory rules while in the laboratory 41 12 32 15 room The science teacher evaluates students after 59 9 26 6 completing the practicum The principal once noticed when you were 12 6 53 29 carrying out practicum activities

#### Table 1. Questionnaire Respond

#### **Result and Discussion**

This study aimed to look at the readiness and utilization of the laboratory by examining several indicators, namely the readiness of laboratory facilities and infrastructure, the level of use of the laboratory, the readiness of human resources, the relationship between the readiness and use of the laboratory and the results of the National Examination, as well as the factors that influence laboratory utilization. This research was conducted by giving questionnaires to students, teachers, and laboratory assistants, making observations in the physics laboratory, conducting interviews, and conducting documentation studies.

This research was conducted in high schools taking a sample of eight schools with one study group each, one physics teacher, and one laboratory assistant (if any). Student respondent data can be seen in Table 1.

The first question is: knowing the laboratory work program activities at school, there were around 12% of students who said this was important. While 6% said it was very important. While 76% of students said that it was not too important. Then the remaining 6% said it was very unimportant. At the 2nd question, 24% of students responded that it was extremely important to know each member's responsibilities as the manager of the school's scientific laboratory in response to the second question. 6% thought it was very significant, however. With regard to the remaining 61% of students, 9% of them acknowledged that knowing this was not particularly crucial.

For the 3<sup>rd</sup> question, 18% of students responded in favor of knowing the organizational structure of science laboratory supervisors in schools in response to Question 3. Only 6% of respondents believed it was really important. There were a few students who said it didn't really matter. Around 24% of students said that knowing the responsibilities of each member of the scientific lab management at the school was pretty significant, and 6% said that this feature was very important. However, roughly 61% of students acknowledge that this claim is not particularly significant. And the others don't give it much thought. Around 24% of students said that knowing the responsibilities of each member of the scientific lab management at the school was pretty significant, and 6% said that this feature was very important. However, roughly 61% of students acknowledge that this claim is not particularly significant. And the others don't give it much thought.

In the questionnaire about how the laboratory usage schedule is communicated to students in each class, approximately 25% of students said this was quite important. Then there were 12% who said it was very important. However, 44% of students said this was not important, with 19% of students saying it was very unimportant. Meanwhile, the 4<sup>th</sup> questions Be aware of requests for tool and material cards, resulting in 47% of students stating that it is quite important, with 12% stating it is very important. But approximately 35% of students said it was not too important. and the rest, 15%, said it was not important.

The 6<sup>th</sup> questions, Know the storage of laboratory equipment and materials, resulting in 41% of students stating that it was quite important, with 12% stating that it was very important. But approximately 35% of students said this was not very important. and the rest, 12%, said it was not important. And the 7<sup>th</sup> question, around 24% of students said that knowing the responsibilities of each member of the scientific lab management at the school was pretty significant, and 6% said that this feature was very important. However, roughly 61% of students acknowledge that this claim is not particularly significant. And the others don't give it much thought.

For the science teacher evaluates students after completing the practicum. As a consequence, 26% of students said it was extremely significant, and 59% of students said it was very important. However, about 9% of students claimed that this was not particularly significant. 6% of the remainder claimed it was unimportant. The 10<sup>th</sup> question, 12% of students believe it to be pretty important, while 6% believe it to be extremely important. However, over 53% of students believed this was not particularly significant. and 29% of those remaining believed it was extremely unimportant. The planning process starts with science teachers submitting a proposed list of tools and materials based on needs analysis and a priority scale because the availability of tools and materials is very limited. The proposal is given to the laboratory assistant to be checked again, and then given to the head of the laboratory to be made into a needs proposal, which is then submitted to the deputy principal for facilities and infrastructure for review. Work program planning at this school is done annually and semi-annually.

This is not entirely consistent with Atmadja (2013) theory, which claims that planning laboratory activities can be done in a number of ways, including creating annual programs, scheduling lab activities, managing human resources, and creating SOPs (usage of equipment and materials). This laboratory work program was totally funded by BOS money, which were allocated. As a result, one month before to the start of the school year, the laboratory purchases its equipment and supplies. Making a plan for a laboratory work schedule that covers tool and material acquisition, scheduling, and tool and material maintenance.

The school principal is in charge, and the group's members are science teachers. This school's organizational structure complies with work regulations for school/madrasah laboratory staff published by the Ministry of Education and Culture in 2017. However, none of the members' qualifications are up to par. According to Permendiknas Number 26 of 2008 concerning Standards for School/Madrasah Laboratory Personnel, in order to become a laboratory head, one must possess a certificate from a university or other recognized institution, and in order to become a laboratory assistant, one must possess a certificate from a recognized school/madrasah.

In general, Rumilah (2006) assertion that the laboratory will be used effectively and efficiently if it is equipped with administration such as an inventory of tools and materials, equipment maintenance and repair, practicum activity services, and a list of tools and materials is not supported by the arrangement of laboratory administration. Laboratory administration in this school is still far from good because it is not organized neatly, and administration that has never been updated will make the management of this laboratory not run according to the work program that has been made.

The administration that was made by the previous administrators from 2018 until now entering 2020 has not been replaced, and moreover, the practicum journal that should have existed at the time of carrying out the practicum has not been replaced. When the teacher is going to hold a practicum activity, he should write in the practicum journal the date on which the practicum was carried out, what materials are practiced, and what 8231 classes are used, so that later from the journal you can check what practicums are already running and the tools and materials used. Administration like this should always be made because it is authentic evidence when there are classes that carry out practicums, what tools and materials are used, and what materials are used up.

According to the head of the laboratory, the implementation of the laboratory work program at this school has only progressed to 50% of the planned work program that has been made. One of the obstacles in its implementation is limited tools and materials and also schedules that conflict with other classes, swelling in each class means that the practical implementation does not run conducively. The implementation of laboratory management should be viewed in the context of the laboratory's orderly use, practicum use, and method for implementing practica. Operational operations in a laboratory are another name for implementation activities. In order for the planned activities to go smoothly, a number of factors need to be taken into account and prepare.

Science teachers must be able to develop practicum tools that can later guide students to find out the truth of a theory. However, in this school students rarely carry out practicums, but only learn in class. If there is material whose tools and materials are easy to find and environmentally friendly, then the practicum activities are carried out at home, in the classroom or in demonstrations. But it is different from Rumilah (2006) who stated in her research that in the implementation of the laboratory it must be equipped with the provision and return of material tools, storage of tools and materials, the existence of laboratory rules that are clearly displayed, and outreach to students regarding safety while performing work in the lab. It is crucial to do this so that the administration can later assess whether the laboratory work program's implementation in the school went according to the planned course of action and whether it was successful, allowing them to offer suggestions for improvement.

The key to putting the created work program into practice is supervision and evaluation (Arifin, 2001). Reports on the outcomes of work program activities are consistently used as a benchmark for developing new work programs because they show which projects are succeeding or have been completed and which have not. The laboratory at this school also uses supervision as an evaluation tool; this is only done internally and is done every odd semester with the help of the lab assistants, head of the lab, deputy head of facilities and infrastructure, and school principal. In addition to determining how far the program has progressed, this activity aims to identify any challenges encountered in carrying out the developed work program. The appropriate government, which serves as a supervisor in its area, also supervises this laboratory. Only sometimes does the government provide supervision, therefore laboratory managers may also be affected since it is a reality in schools that when they know an evaluation will be done and the supervisor will be there, they just make and prepare everything. This reality is commonly carried out by several schools.

It would be better if everything was done according to the provisions. This is not in accordance with the opinion of Rumilah (2006) who believes that supervision of science laboratory management is considered effective if in the supervision there is a clear supervision program, there is a supervisory visit book and a clear report document on the results of the implementation of the laboratory work program. One of the main factors in laboratory management is the laboratory assistant. In accordance with the reality at school, the laboratory assistant is not purely a laboratory assistant, but is a science teacher who doubles as a laboratory assistant. This greatly influences the course of a practicum for science teachers, because they have very limited time to prepare practicum tools and materials, not to mention managing the large number of students. In accordance with the reality found in schools, the existing laboratory assistants are not always on standby in the laboratory room, but the laboratory assistants also have to teach in class so that if a teacher wants to use the lab, they must first ask the laboratory assistant for the key, and then check the tools and materials (Mulyasa, 2009).

This makes teachers lack time to carry out practicums, and in the end, practicum activities stop, making teachers prefer to carry out demonstrations and show videos related to the material that should be in practicum. This is in line with the opinion of the Ministry of National Education. The management of laboratories is frequently hampered by the staff's lack of expertise and experience. In order to develop qualified lab assistants in the future, specialized training or workshops are required with reference to the management of science laboratories in particular.

A practicum will run well if the facilities and infrastructure are adequate; this is also very important in laboratory management. One of the informants also stated that his experience when carrying out practicum material on measuring the number of calipers, micrometers, and balances was very limited; moreover, these tools were no longer suitable for use. So teachers can only introduce these tools to students so that they know the measurement tools; however, it is a shame that students cannot practice directly how to measure using these measuring tools. This agrees with Adriani (2016) in his research, who said that monitoring the availability of tools and materials must be carried out optimally so that later the implementation of the practicum and its management can run smoothly. The students and time, the teachers said that the number of students also affects the implementation of the practicum, because the number of classes is not ideal and the tools and materials are limited, it will take quite a long time to carry out the practicum. They actually used the very limited time well, however, because of these constraints they had to use tools and materials alternately, thus making the practicum implementation not run efficiently.

### Conclusion

Based on the research results, it can be concluded that the management of science laboratories in high schools is not good because there are still many activities in the planning program that have not been carried out in accordance with the plans. Planning, which includes the preparation of a work program, is planned one month before the start of the school year and made at the start of the school year. This includes funding, laboratory use schedules, provision of tools and materials, equipment repairs, and also rules and regulations. Organization, which includes organizational structure and administration, has not been implemented properly, such as there being no updates to the laboratory organizational structure, which means that students also do not know who is managing the laboratory. Administration is also not done well because there is no practicum journal, equipment loan and return cards, or updated list of tools and materials. Implementation of practicum activities is rarely carried out in the laboratory due to limited tools and materials. Supervision and evaluation, namely by supervising internal schools and having supervisors come from the government. Factors that contribute to the management of this laboratory are laboratory assistants, students, time, and limited equipment and materials.

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#### **Author Contributions**

Mohzana and Hary Murcahyanto conceptualized the research idea, designed of methodology, management and coordination responsibility, analyzed data, conducted a research and investigation process; Muh. Fahrurrozi and Yudi Nur Supriadi conducted literature review and provided critical feedback on the manuscript.

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#### Conflicts of Interest

All authors declare no conflicts of interest.

#### References

- Adriani, N. (2016). Analisis Manajemen Laboratorium Kimia SMA Negeri di Kota Tanjung Pinang Guna Meningkatkan Kompetensi Guru dan Pesera Didik. *Jurnal Zaruh*, 4(1), 1-8. https://doi.org/10.31629/zarah.v4i1.135
- Ali, L.U., Suastra, I. W., & Sudiatmika, A. A. I. A. R. (2013). Pengelolaan Pembelajaran IPA Ditinjau dari Hakikat Sains pada SMP di Kabupaten Lombok Timur. Jurnal Pendidikan dan Pembelajaran IPA Indonesia, 3(1). Retrieved from https://ejournal-

pasca.undiksha.ac.id/index.php/jurnal\_ipa/articl e/view/750

- Arifin, Z. (2001). Evaluasi Pembelajaran. Bandung: Remaja Rosdakarya. Retrieved from https://staffnew.uny.ac.id/upload/131656343/p enelitian/EVALUASI%20PEMBELAJARAN.pdf
- Arikunto, S. (2011). *Dasar-Dasar Evaluasi Pendidikan*. Jakarta: Bumi Aksara. Retrieved from https://staffnew.uny.ac.id/upload/132243758/p enelitian/buku%20cepi%20-%20Copy.pdf
- Astuti, R. (2010). Kesiapan Laboratorium Biologi SMA Negeri di Kabupaten Blora dalam Mendukung Pelaksanaan Pembelajaran Biologi (Skripsi). Universitas Negeri Semarang, Semarang. Retrieved from http://lib.unnes.ac.id/10927/1/12230.pdf

Atmadja, S. W. (2013). *Menuju Pengelolaan Laboratorium yang Lebih Baik*. Dinas Pendidikan Kabupaten Klaten: Diklat Pengelolaan Laboratorium. Retrieved from Unwidha.co.id/workshoplaboratoriu mpengelolaan laboatorium pdf

- Azhar, A. (2008). Pendidikan Fisika dan Keterkaitannya dengan Laboratorium. *Jurnal Geliga Sains*, 2(1), 7-12. Retrieved from https://jgs.ejournal.unri.ac.id/index.php/JGS/ar ticle/view/1582
- Azhar, A. (2016). *Pendekatan Keterampilan Proses*. Retrieved from http://www.sarjanaku.com
- Decaprio, R. (2013). *Tips Mengelola Laboratorium Sekolah*. Yogyakarta: Diva Press. Retrieved from https://onesearch.id/Record/IOS3.INLIS0000000 00001106
- Eka, N. (2012). Studi Pemanfaatan Peralatan Laboratorium Fisika dalam Mendukung Pelaksanaan Pembelajaran Fisika Kelas X dan XI di SMA Negeri Kabupaten Banyuwangi Wilayah Selatan-Barat. *Jurnal Pembelajaran Fisika*, 1(2), 185-191. https://doi.org/10.19184/jpf.v1i2.23157

- Hartinawati, H. (2010). Pengelolaan Laboratorium IPA. Jakarta: Universitas Terbuka. Retrieved from https://pustaka.ut.ac.id/lib/pepa4201pengelolaan-laboratorium-ipa/
- Herawati, S. (2016). Keterampilan Berpikir Kritis. Retrieved from http//herawatisusilobioum.com/news
- (2006). Laboratorium Sekolah Kertiasa, N. dan Pengelolannya. Bandung: Pudak Scientific. Retrieved from https://onesearch.id/Record/IOS3757.JATEN000 00000039302
- Lubis, M. (1997). Materi Pokok Pengelolaan Laboratorium IPA. Jakarta: Depdikbud. Retrieved from http://library.fmipa.uny.ac.id/opac/index.php?p =show detail&id=68&keywords=
- Mastika, I. N., Arnyana, I. B. P., & Setiawan, I. G. A. N. (2014). Analisis Standarisasi Laboratorium Biologi dalam Proses Pembelajaran di SMA Negeri Kota Denpasar. Jurnal Pendidikan dan Pembelajaran IPA Indonesia, https://ejournal-4(1). pasca.undiksha.ac.id/index.php/jurnal\_ipa/articl e/view/1077
- Mulyasa, E. (2009). Manajemen Berbasis Sekolah. Bandung: Remaja Rosdakarya Offset. Retrieved from https://inlislite.uin-suska.ac.id/opac/detailopac?id=23049
- Mulyasa, E. (2013). Pengembangan dan Implementasi Kurikulum 2013. Bandung: Remaja Rosdakarya Offset. Retrieved from https://onesearch.id/Record/IOS5906.ai:slims-5894/TOC
- Nuada, I. M. (2015). Analisis Sarana dan Intensitas Penggunaan Laboratorium terhadap Keterampilan Proses Sains Siswa SMA Negeri Se-Kota Tanjungbalai (Thesis). UNIMED. Retrieved from http://digilib.unimed.ac.id/5373/
- Purnawan, E. B. (2009). Analisis Kualitas Pelayanan Pendidikan di SMA PGRI Jepara (Thesis). UNNES, Semarang. Retrieved from http://eprints.undip.ac.id/24627/1/Eko\_Budi\_P urnawan.pdf
- Rahmiyati, (2008). Keefektifan Pemanfaatan S. Laboratorium di Madrasah Aliyah Yogyakarta. Jurnal Penelitian dan Evaluasi Pendidikan, 11(1), 88-100. http://dx.doi.org/10.21831/pep.v11i1.1420
- Rumbinah, R. (2016). Standarisasi dan Pengelolaan Laboratorium IPA. Retrieved from www.snapdrive.net/files/571708/pengelolaan%20labor atorium%20 ipa. ppt. 2008.
- Rumilah, R. (2006). Kefektifan Manajemen Laboratorium IPA SMP Negeri di Kabupaten Bantul. Yogyakarta: PPs UNY.

https://doi.org/10.23887/jppsi.v3i2.29592

- Sugivono, S. (2018). Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Bandung: Alfabeta. Retrieved from https://inlislite.uinsuska.ac.id/opac/detail-opac?id=22862
- Sukmadinata, N. S. (2013). Metode Penelitian Pendidikan. Bandung: Remaja Rosdakarya Offset. Retrieved from https://inlislite.uinsuska.ac.id/opac/detail-opac?id=22622
- Sumintono, B., Ibrahim, M. A., & Phang, F. A. (2010). Pengajaran Sains dengan Praktikum Laboratorium: Perspektif dari Guru-Guru Sains SMPN di Kota Cimahi. Jurnal Pengajaran MIPA, 15(2), 120-127. https://doi.org/10.18269/jpmipa.v15i2.36002
- Sundari, R. (2008). Evaluasi Pemanfaatan Laboratorium dalam Pembelajaran Biologi di Madrasah Aliah Negeri Sekabupaten Sleman. Jurnal Penelitian dan Evaluasi Pendidikan. 196-222. 12(2), https://doi.org/10.21831/pep.v12i2.1427
- Supriatna, M. (2012). Studi Penelusuran Pengelolaan Laboratorium Sains SMA sebagai Analisis Kebutuhan untuk Progam Diklat Pengelola Laboratorium. Retrieved from http://library.walisongo.ac.id//digilib/files/dis k1/140/jtptiain--
- Sutrisno, S. (2016). Keterampilan Berpikir untuk Meningkatkan Mutu Pembelajaran. Retrieved from http://www.scribd.com/doc/54977805/artikelerlangga
- Syaifulloh, M., Wibowo, B., & Siswandi, S. (2014). Pemanfaatan Laboratorium Sejarah sebagai Sumber Belajar Sejarah (Studi Kasus Mahasiswa Program Studi Pendidikan Sejarah Semester III STKIP PGRI Pontianak). Sosial Horizon: Jurnal Pendidikan Sosial, 1(1), 59-72. https://doi.org/10.31571/sosial.v1i1.148
- Wasilah, E. B. (2012). Peningkatan Kemampuan Menyimpulkan Hasil Praktikum IPA melalui Penggunaan Media Kartu. Jurnal Pendidikan IPA, 1(1), 82-90.

https://doi.org/10.15294/jpii.v1i1.2018