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Analysis of The Utilization of Physics Laboratories in Several High Schools/Islamic Schools in Langkat Regency

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Abstract

This study aims to determine the condition of infrastructure facilities and the utilization of physics laboratories, to determine the utilization of physics laboratories, and to determine the inhibiting factors in the implementation of physics practicum activities in several SMA/MA in Langkat Regency. This type of research is an explorative survey, namely by observing and exploring (digging). Data collection was carried out through observation, surveys, interviews and documentation. The population in this study were all SMA/MA in Langkat Regency which had a physics laboratory. The sample in this study were 5 SMA/MA in Langkat Regency, namely Stabat 1 Public High School, Yapim Taruna Stabat Private High School, Padang Tualang 1 Public High School, Tanjung Pura 1 Public High School and Langkat 1 Public High School. Based on the results of data analysis, it was concluded that physics laboratories in several high schools/MA in Langkat Regency were classified as good with a percentage value of 70% according to Permendiknas No.24 of 2007. Laboratory utilization in general obtained a percentage value of 81% with a very good category. Inhibiting factors in the use of laboratories include insufficient time allocation, availability of practicum tools and materials, and the minimum number of laboratory assistants.

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INTRODUCTION

Physics is a branch of science that studies natural events or natural phenomena and their occurrences. However, in reality, the level of success in learning physics is not optimal. Success in learning physics also requires good facilities and infrastructure that are adequate to support the creation of effective learning, for example the availability of a physics laboratory and good tools (Kencana, 2016). Some of the subject matter in physics cannot be understood by students if they only rely on theory in learning activities,

because learning physics is always related to events or incidents that exist in human life, so students need experiments that can prove every phenomenon in real terms. (Sari & Sani, 2019).

Based on Permendiknas Number 24 of 2007, a laboratory is a place where scientific research, experiments, measurements or scientific training is carried out. The physics laboratory is one of the standard facilities and infrastructure that must be carried out by every formal education unit, including SMA/MA. The physics laboratory room can accommodate a minimum of one study group with a minimum physics laboratory space ratio of 2.4 m2/student. For study groups with less than 20 students, the minimum area of the physics laboratory is 48 m2 including the storage and preparation room area of 18 m2. The minimum width of the physics laboratory room is 5 m (Islamisi, 2016). Therefore, through various government programs, efforts have been made to meet the needs of SMA/MA physics laboratories starting from procuring buildings, infrastructure, laboratory equipment and materials as well as preparing human resources through training of teachers on physics laboratory management (Suseno & Riswanto, 2017).

The existence of a physics laboratory also has a very important role in the practicum activities carried out. The physics laboratory has a function as a container or place for the process of learning activities to take place which aims to find facts, concepts and learning processes scientifically. Intensive use of physics laboratories is able to produce students' science process abilities to improve students' learning processes. (Satrio & Sabani, 2019). One way that can make students participate actively in learning activities to support the creation of an efficient learning process is the practicum method (Sari & Sani, 2019).

One of the important problems in learning physics is the low quality of learning at various levels of education. The quality of the process and results of learning physics is determined by many factors, one of which is the availability of infrastructure and the level of utilization of physics laboratories. Laboratory activities are important things to do in physics learning, because through laboratory activities aspects of the products, processes, and attitudes of students can be further developed. These abilities are very important to equip students in solving various problems faced in society (Iskandar, 2016).

Practicum activities really help the student learning process, this can be seen from research conducted (Erniwati et al., 2014) which concluded that the use of practicum can improve student learning outcomes. Likewise, research from (Samsudin, 2012) also concluded that practicum increases students' learning motivation. Meanwhile, according to (Yanti et al., 2016), adequate infrastructure supports practicum for students to gather information. There are still many obstacles which are factors that make practicum less applicable. According to (Dewi, 2014) who stated that the constraints in the implementation of practicum were influenced by several factors, namely: physics laboratory facilities that were not utilized optimally, limited school support, lack of management of physics laboratories, the factor of teachers who did not prepare enough for practicum implementation was not assisted by laboratory assistants. or laboratory technicians, and others.

Based on the above background, the formulation of the problem in this study is obtained, namely: 1) What is the condition of the supporting infrastructure for physics practicum activities in several SMA/MA in Langkat Regency?, 2) How is the utilization of physics laboratories in several SMA/MA in Langkat Regency?, 3) What are the inhibiting factors in the implementation of physics practicum activities in several SMA/MA in Langkat Regency?

Based on the formulation of the problem, the aims of this research are 1) To find out the condition of supporting infrastructure for physics practicum activities, 2) To find out the use of physics laboratories, 3) To find out the inhibiting factors in the implementation of physics practicum activities.

METHOD

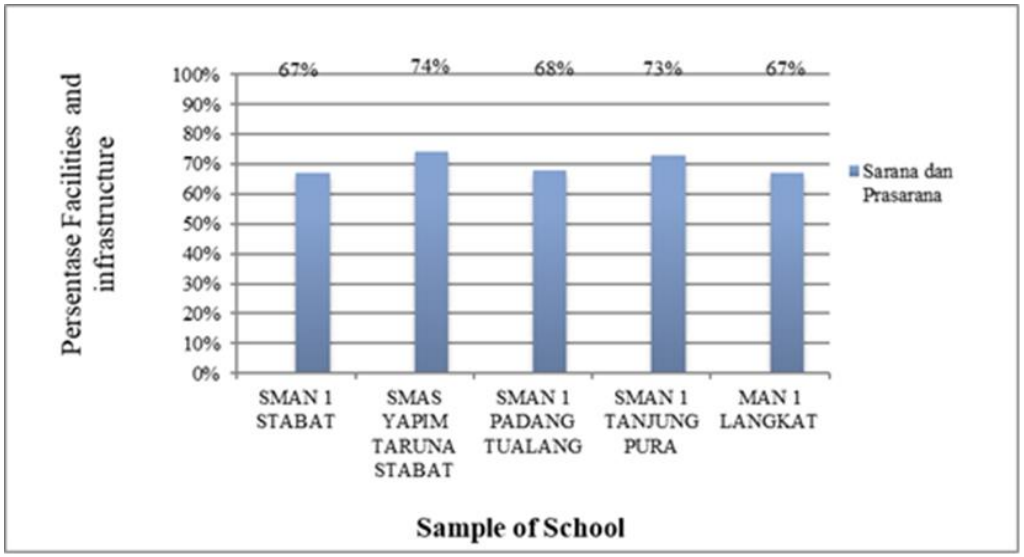
This research is an explorative survey research with descriptive method. The time of the research was conducted in the even semester of February-April 2020. Based on the research objectives, the population in this study were all public and private SMA/MA in Langkat Regency. The sample in this study consisted of 5 schools, namely Stabat 1 Public High School, Yapim Taruna Stabat Private High School, Padang Tualang 1 Public High School, Tanjung Pura 1 Public High School, and Langkat 1 State Senior High School, which were taken by purposive sampling technique, namely sampling according to the purpose research where sempel is a school that uses the 2013 curriculum and is willing to accept this research. In this study, data were obtained by several methods, namely: direct observation, distribution of surveys, interviews, and documentation.

RESULTS AND DISCUSSION

The research results obtained from the collection and processing of data from the survey that the researchers conducted with teachers, laboratory assistants, and students regarding the use of laboratories related to: (1) the suitability of the condition of physics laboratory facilities in accordance with Permendiknas Number 24 of 2007, (2) utilization of physics laboratories in schools, and (3) inhibiting factors in the use of physics laboratories in schools. The results of the observational analysis of physics laboratory facilities in several SMA/MA in Langkat Regency can be seen in TABLE 1.

TABLE 1. Completeness of Physics Laboratory Facilities and Infrastructure in Several High Schools/MA in Langkat Regency

Aspect	SMAN 1 Stabat	SMAS Yapim Taruna Stabat	SMAN 1 Padang Tualang	SMAN 1 Tanjung Pura	MAN 1 Langkat	Average (%)
Facilities and infrastructure	67%	74%	68%	73%	67%	70%



Referring to TABLE 1, it can be concluded that the average percentage of physics laboratory facilities and infrastructure in several high schools/MA in Langkat Regency is in the good category, with a percentage of 70%. Utilization of the physics laboratory is seen from several variables, namely: 1) practicum preparation, 2) completeness of practicum tools and materials, 3) practicum implementation. The results of the physics laboratory utilization analysis based on the teacher survey can be seen in TABLE 2.

TABLE 2. Utilization of Physics Laboratories in Several High Schools/MA in Langkat Regency Based on a Teacher Survey

No	Variable	Teacher's Code					Percentation (%)
		R1	R2	R3	R4	R5	
1	Practicum Preparation	82%	82%	86%	79%	89%	84%
2	Completeness of Practicum Tools and Materials	80%	86%	73%	75%	89%	81%
3	Practicum Implementation	80%	86%	84%	77%	91%	84%
Average							83%

Keterangan :
R1 : Guru SMAN 1 Stabat
R2 : Guru SMA Swasta Yapim Stabat
R3 : Guru SMAN 1 Padang Tualang
R4 : Guru SMAN 1 Tanjung Pura
R5 : Guru MAN 1 Langkat

Based on TABLE 2, the average percentage value of physics laboratory utilization is obtained in the very good category. Judging from each of the variables that have been studied, the highest percentage score is practicum preparation and practicum implementation which has the same value, namely 84% which indicates that practicum preparation and practicum implementation in several SMA/MA in Langkat Regency have been carried out very well. Meanwhile, the percentage of namely the completeness of practicum tools and materials with a percentage value of 81% which indicates that the completeness of practicum tools and materials is also in very good condition. For the average percentage value of physics laboratory utilization based on the teacher survey, which is equal to 83%, this shows that the level of utilization of physics laboratories in several high schools/MA in Langkat Regency based on the teacher survey is already in the very good category. The results of the physics laboratory utilization analysis based on laboratory assistant surveys can be seen in TABLE 3.

TABLE 3. Utilization of Physics Laboratories in Several High Schools/MA in Langkat Regency Based on Laboratory Assistant Survey

No	Variable	Laboratory Assistant's Code					Percentation (%)
		R1	R2	R3	R4	R5	
1	Practicum Preparation	79%	82%	96%	89%	100%	89%
2	Completeness of Practicum Tools and Materials	64%	86%	77%	91%	79%	79%
3	Practicum Implementation	75%	89%	84%	79%	91%	84%
Average							84%

Keterangan :
R1 : Laboran SMAN 1 Stabat
R2 : Laboran SMA Swasta Yapim Stabat
R3 : Laboran SMAN 1 Padang Tualang
R4 : Laboran SMAN 1 Tanjung Pura
R5 : Laboran MAN 1 Langkat

Based on TABLE 3, the average percentage value of physics laboratory utilization is obtained in the very good category. Judging from each variable that has been studied, the highest percentage score is practicum preparation which has a percentage value of 89% which indicates that practicum preparation

in several SMA/MA in Langkat Regency has been carried out very well. Meanwhile, the next highest percentage was practicum implementation with a percentage value of 84% indicating that practicum implementation in several SMA/MA in Langkat Regency had been carried out very well.

For the lowest percentage value, namely the completeness of practicum tools and materials with a percentage value of 79% which indicates that the completeness of practicum tools and materials is also in good condition. For the average percentage value of physics laboratory utilization based on laboratory assistant surveys, that is equal to 84%, this shows that the level of utilization of physics laboratories in several high schools/MA in Langkat Regency based on laboratory assistant surveys is already in the very good category. The results of the physics laboratory utilization analysis based on a student survey can be seen in TABLE 4.

TABLE 4. Utilization of Physics Laboratories in Several High Schools/MA in Langkat Regency Based on a Student Survey

No	Variable	Student's Code					Percentation
		R1	R2	R3	R4	R5	(%)
1	Practicum Preparation	82%	89%	82%	82%	74%	82%
2	Completeness of Practicum Tools and Materials	73%	76%	77%	78%	67%	74%
3	Practicum Implementation	75%	71%	81%	76%	69%	74%
Average							77%

Keterangan :
R1 : Siswa SMAN 1 Stabat (20 orang)
R2 : Siswa SMA Swasta Yapim Stabat (20 orang)
R3 : Siswa SMAN 1 Padang Tualang (20 orang)
R4 : Siswa SMAN 1 Tanjung Pura (20 orang)
R5 : Siswa MAN 1 Langkat (20 orang)

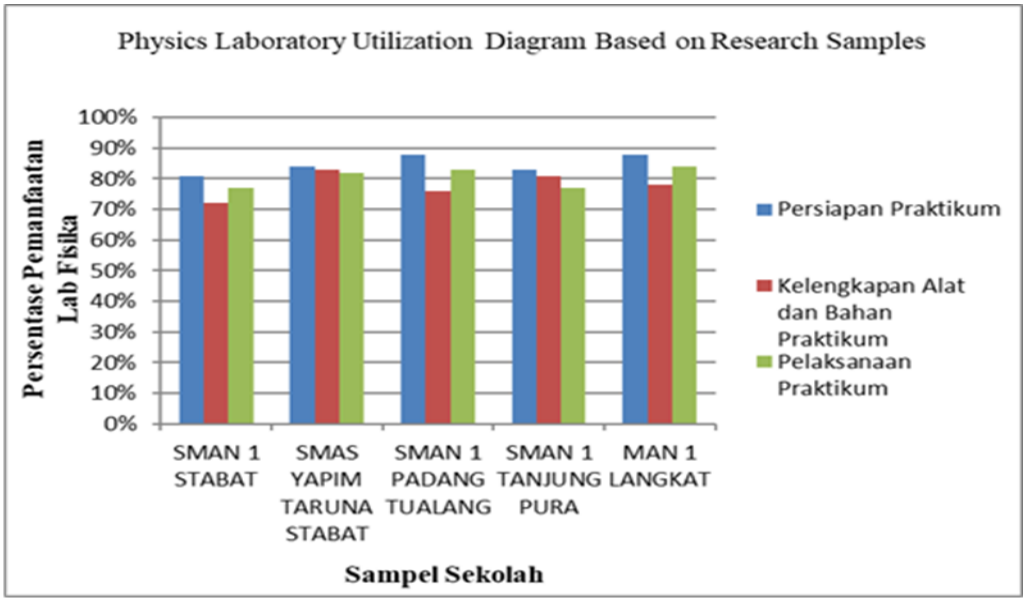
Based on TABLE 4, it can be seen that the average utilization of physics laboratories is in the good category. Judging from each variable that has been studied, the highest percentage score is practicum preparation which has a percentage value of 82% which indicates that practicum preparation in several SMA/MA in Langkat Regency has been carried out very well. For the completeness of practicum tools and materials with a percentage value of 74% which indicates that the completeness of practicum tools and materials is also in the good category. Practicum implementation

also obtained the same percentage score of 74% indicating that the practicum implementation was also in the good category. For the average percentage value of physics laboratory utilization based on student surveys, which is equal to 77%, this shows that the level of utilization of physics laboratories in several high schools/MA in Langkat Regency based on student surveys is already in the good category. The results of the analysis of the utilization of the physics laboratory based on a combined survey of respondents for each school can be seen in TABLE 5.

TABLE 5. Utilization of Physics Laboratories in Several High Schools/MA in Langkat Regency Based on a Joint Survey of Respondents for Each School

No	Variabel	SMAN 1 STABAT	SMAS YAPIN TARUNA STABAT	SMAN 1 PADANG TUALANG	SMAN 1 TANJUNG PURA	MAN 1 LANGKAT
1	Practicum Preparation	81 %	84%	88%	83%	88%
2	Completeness of Practicum Tools and Materials	72 %	83%	76%	81%	78%
3	Practicum Implementation	77 %	82%	83%	77%	84%

	Average	77%	83%	82%	80%	83%
	Category	Good	Very Good	Very Good	Good	Very Good



Based on TABLE 5, it can be concluded that the utilization of the physics laboratory at Stabat 1 Public High School gets a good category, Yapim Taruna Stabat Private High School gets a very good category, Padang Tualang 1 Public High School received a very good category, SMA Negeri 1 Tanjung Pura received a good category, and MA Negeri 1 Langkat received a very good category. The results of a comparative analysis of physics laboratory utilization based on a survey of each respondent can be seen in TABLE 6.

TABLE 6. Perbandingan Hasil Analisis Pemanfaatan Laboratorium Menurut Guru, Laboran, dan Siswa

No	Variabel	Responden			Rata-Rata (%)
		Guru	Laboran	Siswa	
1	Persiapan Praktikum	84%	89%	82%	85%
2	Kelengkapan Alat dan Bahan Praktikum	81%	79%	74%	78%
3	Pelaksanaan Praktikum	84%	84%	74%	81%
	Rata – Rata				81% (sangat baik)

Keterangan :
Total responden guru : 5 orang
Total responden laboran : 5 orang
Total responden siswa : 100 orang

Based on TABLE 6, it can be seen that the three variables have perceptions with a percentage range that is not too far away. For practicum preparation variables, the three results of analysis between teachers, laboratory assistants, and students get very good categories with percentages of 84%, 89%, and 82% respectively. For the variable completeness of practicum tools and materials, get a different category, based on the results of the survey the teachers get a very good category with a percentage of 81%, while the results of the laboratory assistant survey and students get a good category with a percentage of 79% and 74% respectively. For practicum implementation variables, they get a different category, based on the results of the teacher and laboratory assistant survey they get a very good category with a percentage

value of both of 84%. Meanwhile, based on the results of a student survey, they get a good category with a percentage value of 74%. Some of the inhibiting factors that cause not optimal utilization of physics laboratories in schools include the following:

1. Insufficient time allocation
   Availability of time is one of the factors that most hinder the implementation of practicum. Based on the results of interviews conducted with physics teachers at several high schools/MA in Langkat Regency, some teachers stated that the practicum time allocation was not enough to carry out practicums, with a large number of students the teacher found it difficult to manage practicum activities in the laboratory. The allocation of practicum time which is quite short is not able to complete practicum activities during the activity. In addition, to pursue the target of completing learning material that has not been completed due to unexpected factors, this practicum time allocation is often used by teachers in carrying out learning in the classroom. For practicum implementations that were delayed due to insufficient time allocation, some teachers held practicum activities outside of study hours and some other teachers conducted demonstrations in class during learning.
2. Availability of tools and materials
   Based on the results of observations made by researchers regarding physics laboratory facilities, the condition of the laboratory infrastructure as a whole gets a percentage range of 70% with the appropriate category. Even so, there are still incomplete practicum tools and materials which are also in damaged condition. These practicum tools and materials are rarely used and most of them are stored in storage cabinets for quite a long time. So that when the teacher will carry out practicum activities with these tools and materials they cannot be used. However, with this inhibiting factor, most physics teachers in several high schools/MA in Langkat Regency made simple experimental props so that practicum activities could still be carried out. One factor that is not optimal in the implementation of practicum activities is the minimal supporting capacity of the school's science laboratory infrastructure (Hanisa Putri et al., 2014). The visual aids that the teacher has made include simple pendulums, simple series and parallel circuits, simple venturi pipes, simple hydraulic pumps, and simple thermometers. This refers to the Implementation of K-13 which states that teachers are expected to be able to take advantage of the facilities that are already available in schools or find alternatives to fulfill the facilities that do not exist. In the implementation of K-13, teachers are needed who can utilize the facilities in accordance with the demands of the material in the curriculum (Handayani, 2018).
3. The minimum number of laboratory assistants
   Based on the results of the research that has been carried out, it is stated that in general the physics laboratories in several high schools/MA in Langkat Regency do not have laboratory assistants specifically in managing physics laboratories. This is also one of the main factors that hinders the use of physics laboratories in schools. Teachers will also be neglected in managing laboratories if there are no laboratory assistants who participate in managing laboratories in schools. The physics teacher in this case is fully responsible for all activities carried out in the laboratory.

Meanwhile, according to Permendiknas number 26 of 2008 concerning school/madrasah laboratory staff standards, article 1 paragraph 1 states that school/madrasah laboratory staff standards include laboratory heads, technicians and laboratory assistants. The same opinion was also conveyed by Wirjosoemarto et al (2004: 464) regarding the organizational structure and management of the laboratory, laboratory staff or personnel have responsibility for the effectiveness and efficiency of the laboratory including facilities, tools and practicum materials (Suseno, 2017) . The magnitude of the role of the laboratory in science/physics learning will affect physics learning outcomes.

CONCLUSION

Based on the results of the discussion of data analysis of research results, it can be concluded as follows:

1. Overall, the condition of physics laboratory facilities in several high schools/MA in Langkat Regency is in the good category with a percentage value of 70% and in accordance with Permendiknas No. 24 of 2007.
2. The overall use of the laboratory based on a survey of teachers, laboratory assistants and students obtained a percentage score of 81% in the very good category. With an average percentage value based on a teacher survey of 83% in the very good category. Based on the results of the laboratory survey, a percentage value of 84% was obtained in the very good category. The results of the student survey obtained a percentage value of 77% in the good category. For practicum preparation variables as a whole based on a survey of teachers, laboratory assistants, and students, they get a percentage value of 85% in the very good category. For the variable completeness of practicum tools and materials as a whole based on a survey of teachers, laboratory assistants, and students, a percentage value of 78% is obtained in the good category. For practicum implementation variables as a whole based on a survey of teachers, laboratory assistants, and students, a percentage value of 81% is obtained in the very good category.
3. Factors that hinder the use of laboratories in schools include insufficient time allocation, incomplete availability of tools and materials, and the minimum number of laboratory assistants. However, the existence of inhibiting factors in the use of laboratories makes teachers more creative and innovative in reducing these problems. If the time allocation is not enough to carry out practicum activities, some teachers carry it out by conducting demonstrations and some teachers continue to carry out practicum outside school hours. For experimental tools and materials that were incomplete and damaged, most of the physics teachers at several high schools/MA in Langkat Regency made simple teaching aids so that practicum activities could still be carried out. The visual aids that the teacher has made include simple pendulums, simple series and parallel circuits, simple venturi pipes, simple hydraulic pumps, and simple thermometers. The minimum number of laboratory assistants in schools is also one of the inhibiting factors for the use of laboratories, but most of the teachers in the field of physics studies jointly manage the physics laboratory.

Suggestion

Based on the results of the research and conclusions above, the suggestions given from this study are:

1. It should be input for school principals to pay more attention to the condition of the facilities and infrastructure needed to increase the use of existing laboratories in schools and provide special laboratory assistants other than teachers to handle laboratory management in schools.
2. It is hoped that physics teachers at school will be more creative in providing alternative practicums with simple teaching aids if the experimental equipment available in the laboratory is damaged or incomplete.
3. With the information about several schools that were sampled in the study, it should be able to set an example for other high schools in the management and use of physics laboratories.

REFERENCES

Ariesta, R. (2011). Pengembangan perangkat perkuliahan kegiatan laboratorium fisika dasar II berbasis inkuiri terbimbing untuk meningkatkan kerja ilmiah mahasiswa. *Jurnal Pendidikan Fisika Indonesia,* 7**,** 62-68.

Decaprio, Richard. (2013). Tips Mengelola Laboratorium Sekolah; IPA, Bahasa, Computer Dan Kimia, *Diva Press*, Jogyakarta.

Dewi, S. (2014). Analisis Kendala Pelaksanaan Praktikum Biologi di SMA Negeri Se-Kota Palangka Raya. *Edu Sains: Jurnal Pendidikan Sains & Matematika,* 2, 13-26.

Fatonah, et al. (2014). Pembelajaran Sains. Penerbit Ombak (Anggota IKAPI), Yogyakarta

Iskandar, E. (2016). Pengunaan Multimedia Laboratorium Virtual Fisika Untuk Meningkatkan Hasil Belajar Siswa Kelas X SMA N 4 Lahat. *Jurnal Inovasi dan Pembelajaran Fisika,* 3, 61-65.

Islamisi, I. (2016). Manajemen Laboratorium Dalam Pembelajaran Fisika Di Sma Negeri 1 Kota Jambi. *Jurnal Pembelajaran Fisika*, 2, 1-11.

Katili, N. (2013). Analisis Sarana dan Intensitas Penggunaan Laboratorium Fisika Serta Kontribusinya Terhadap Hasil Belajar Siswa SMA Negeri di Kabupaten Jembrana. *Jurnal Pendidikan dan Pembelajaran IPA Indonesia***,** 5, 76-86.

Kencana, M. (2016). Pengaruh Penggunaan Alat Laboratorium Fisika Terhadap Hasil Belajar Siswa Kelas X Sman 8 Banda Aceh Pada Pokok Bahasan Pengukuran. *Jurnal Pendidikan Fisika,* 1, 287-291.

Lafenasti, F. (2018). Analisis Hambatan Pelaksanaan Praktikum Fisika di SMA Negeri 5 Kota Jambi. *Jurnal Pendidikan Fisika,* 1, 1-14.

Munandar, Kukuh. (2015). Pengenalan Laboratorium IPA- Sekolah, Refika Aditama, Bandung.

Sani, Ridwan Abdullah. (2012). Pengembangan Laboratorium Fisika. *Unimed Press*, Medan, 1-97.

Sari, S. (2019). Analisis Keaktifan Siswa Dalam Pembelajaran Praktikum Fisika Di Man 2 Model Medan. *Jurnal Ikatan Alumni Fisika Universitas Negeri Medan,* 4, 11-15.

Satrio, M. (2019). Analisis Sarana Prasarana Dan Pemanfaatan Laboratorium Fisika Sma Negeri Di Kota Medan. *Jurnal Ikatan Alumni Fisika Universitas Negeri Medan,* 4, 6-10.

Sitorus, et al. (2013). Pengelolaan dan Manajemen Laboratorium Kimia. Graha Ilmu, Yogyakarta.

Sumaji, et al. (2012). Pendidikan Sains yang Humanistis. Kanisius (Anggota IKAPI), Yogyakarta.

Suseno, N. (2017). Sistem Pengelolaan Laboratorium Fisika Untuk Mewujudkan Pelaksanaan Praktikum Yang Efisien. *Jurnal Pendidikan Fisika,* 5**,** 76-86.

Yanti, D. (2017). Analisis Sarana Prasarana Laboratorium Fisika dan Intensitas Kegiatan Praktikum Fisika Dalam Mendukung Pelaksanaan Pembelajaran Fisika SMA Negeri Di Kabupaten Jember. *Jurnal Pembelajaran Fisika,* 5**,** 41-46.