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Utilization of the Physics Laboratory to Increase Student Motivation and Learning Outcomes

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ABSTRACT. The minimal use of laboratory facilities by teachers means that physics learning is only carried out in the classroom. This research aims to (1) determine the use of laboratories, motivation and learning outcomes of students at SMA Negeri 6 Wangi-Wangi, (2) determine the effect of use of laboratories on learning motivation, and (3) determine the effect of use of laboratories on learning outcomes. This research was carried out using an experimental research design. This research data was taken using multiple choice questions which were then given to class XI students. The results of the research show that (1) the use of laboratories at SMA Negeri 6 Wangi-Wangi is not optimal, students have never studied in a laboratory, so their motivation and learning outcomes in physics have not reached the KKM, (2) after learning in the laboratory, the average learning motivation increased from 68.72 to 81.3, and (3) there was no difference in learning outcomes before learning in the laboratory (tcount = 2.34 < ttable = 1.72), but learning outcomes increased significantly after treatment (tcount = -35.70 < ttable = 1.72). Based on this, it can be concluded that learning in the laboratory increases students' motivation and physics learning outcomes.

1. Introduction

Every educational institution in the modern era is very dependent on the presence of advice and infrastructure. There is not a single school that neglects the facilities and infrastructure for the educational process. In the National Education Standards, the main presentation also discusses standards for facilities and infrastructure (Yustikia, 2019). This can be seen in the Government Regulation of the Republic of Indonesia Number 19 of 2005 concerning National Education Standards article 42(dalam Mataputun, 2020) namely: Every

educational unit is required to have furniture, educational equipment, educational media, books and other learning resources, consumables, and other equipment needed to support an orderly and sustainable learning process. And every educational unit is required to have infrastructure which includes land, classrooms, educational unit leadership rooms, laboratory rooms, workshop rooms and unit rooms to prove theories found in books and so on (Sinta, 2019). Judging from its function, firstly, the laboratory is a place for educators to explore concepts, develop learning methods, enrich knowledge and skills, and so on. Second, as a place for students to learn, understand, develop skills, and apply the theory they have learned during class.

With a laboratory, the learning process does not only occur in the classroom, students can immediately participate in practicums with direction from the subject teacher, so that the information obtained by students will tend to be more easily stored in the child's brain memory. Having a laboratory in a school not only builds students' understanding of the practices carried out, but what is no less important can foster the scientific skills of a student. However, if we look at schools, especially at the SMA/MA level, we still find many schools that have laboratory facilities but do not utilize or utilize these laboratories optimally. In fact, there are still many schools that use laboratories as classrooms. This happens because there is no process of adding classrooms, so that spaces that are deemed not really needed in the learning process can be used as classrooms (Sarjono, 2018). There are many reasons why a laboratory is not used to support learning, including inadequate laboratory space, lack of available tools and materials, and no administration to manage the laboratory. Physics learning that is only carried out in the classroom without using a laboratory makes students' learning motivation low.

Motivation comes from within students to carry out certain activities to achieve a goal in learning science (Gani et al., 2022). Setiawati et al., (2021) The research results show that the existence of a laboratory can support learning carried out by teachers, this can be seen from the availability and the way it is managed well by the school. Apart from that, the school also uses the science laboratory as a learning place and has a positive influence on student learning outcomes compared to conventional learning models (Lubis & Rizkika, 2017).

Based on the results of the researcher's interview with the class XI physics teacher at SMA Negeri 6 Wangi-Wangi, SMA Negeri 6 Wangi-Wangi already has a laboratory. It could be said that the laboratory is not very adequate even though it already has tables, chairs, storage for practical equipment and laboratory equipment, it's just not complete. The teachers who teach physics subjects are not physics teachers, so the use of laboratories there is not optimal and students never even do physics practicum. So it was found that in the learning process in class students were not motivated to study physics and this resulted in their physics learning outcomes being low. This is because the learning process is still often monotonous, the choice of models is not appropriate, and the lack of students' ability to understand and master the concepts in the material itself. Often students imagine that learning physics is complicated so that students' focus on the material being taught is reduced and there is a lack of student motivation to solve these problems. Because learning tends to be dominated by educators who at the implementation stage of learning start with explaining the material and continue with practice questions. So students cannot solve a problem and are not given the opportunity to think about and find their own concepts. The KKM scor for class XI for all subjects is 75 and the average score for physics subjects in class XI IPA is 71.954. So the researchers consider that using a laboratory is very suitable to be implemented at SMA Negeri 6 Wangi-Wangi considering that there they have never used a laboratory as a place for physics learning in order to increase student motivation and learning outcomes.

Through this research, it is hoped that effective learning strategies can be found in the use of physics laboratories so that they can make a real contribution in increasing students' learning motivation and physics learning outcomes.

2. Research Methods

Based on the types of problems found in this research, researchers used experimental research methods. In this research, an experimental class is used, namely students will receive learning treatment in the laboratory. Before being given treatment, a pretest is first given to find out the initial conditions, whether there is any

improvement before and after the experimental class. This research uses a pretest-posttest group only design (Sugiyono, 2019). The subjects in this research were all students of class XI Science at SMAN 6 Wangi-Wangi consisting of class XI Science. The sample was determined using a saturated sampling technique of 22 people. Data collection techniques were carried out using observation, learning results tests and learning motivation questionnaires. Data were analyzed using statistical tests, namely descriptive statistical analysis and inferential analysis to compare differences in motivation scores and learning outcomes in the experimental class. The results of this analysis are used to identify the extent to which the use of physics laboratories contributes to increasing student motivation and learning outcomes. This research data was processed using the SPSS program.

3. Results and Discussion

3.1 Results

3.1.1 *Descriptive Analysis*

Descriptive analysis in this research begins by describing data from learning motivation variables after learning in the laboratory and learning outcomes. For more details, see table 1.

Table 1. Categories of Learning Motivation and Learning Outcomes of Students XI IPA

Data Dissemination and Centralization	Learning Motivation	Learning Outcomes (Pre-Test)
High Score	91	70
Low Score	59	30
Average	81,3	54,5
Median	84,5	57,5
Mode	86	65
Variance	86	140,2
Standard Deviation	9,07	11,8

Source: Descriptive Statistical Analysis Data

Table 1 shows the categories of learning motivation and learning outcomes of class XI IPA students based on data distribution and concentration. The highest score for learning motivation was 91, while the learning result reached 70. The lowest score for learning motivation was 59, while the learning result was only 30. The average learning motivation was 81.3, while the learning result was 54.5. The median learning motivation was recorded at 84.5 and learning outcomes 57.5, with respective modes of 86 for learning motivation and 65 for learning outcomes. The variance in learning motivation is 86, while learning outcomes have a variance of 140.2. The standard deviation of learning motivation is 9.07, smaller than learning outcomes which reach 11.8.

Table 2. Motivational Tendencies of Classroom Students XI IPA

Variable	Interval Class	Fi	(%)	Category
Learning Motivation	X<70	3	13,5	Low
	70≤X≤75	2	9	Currently
	80≤X≤85	14	63	High
	90≤X≤100	3	13,5	Very high
Learning Outcomes	X<75	22	100%	Low
	75≤80		0%	Currently
	81≤90		0%	High
	91≤100		0%	Very high

Source: Research Results 2022

Based on Table 2, it shows that of the 22 students in class students or as many as 63%, in the medium category there are 2 students or as many as 9%, and in the low category there are 3 students or as many as

13.5%. Meanwhile, for physics learning outcomes in the very high category there are as many students or as many as 0%, in the high category there are as many students or as many as 0%, and in the medium category there are 0 students or as many as 0%, and in the low category there are 22 students. or as much as 100%.

Next, a description of the learning outcomes of class XI Science students after learning in the laboratory is carried out, which can be seen in table 3.

Table 3. Category of Student Learning Outcomes XI IPA

Statistics	Post-test
The high score	100
Low value	55
Average	82,5
Median	80,0
Mode	80,0
Variance	152
Standard deviation	12

Source: Research Results 2022

Based on table 3 above, it shows that the Physics learning results of students after learning in the laboratory on Temperature and Heat material for class XI Science consisting of 22 students. Overall, students took the final test (post-test) with the highest score of 100 and the lowest score of 55. Based on the Minimum Completeness Criteria (KKM) which has been determined, namely 75, there are 19 students who are categorized as complete, while 3 other students has not yet reached the complete category.

Table 4. Distribution of Post-test Learning Results in the Experimental Class

Interval Class	Fi	(%)	Category
X<75	3	13,5	Low
75≤80	3	13,5	Currently
81≤90	8	36	High
91≤100	8	36	Very high

Source: Research Results 2022

From Table 4, it shows that of the 22 students who have carried out experiments in this case XI IPA SMA Negeri 6 Wangi-Wangi have physics learning outcomes in the very high category as many as 8 students or 36%, in the high category as many as 8 students or as many as 36%, in the medium category there were 3 students or 13.5% and in the low category there were 3 students or 13.5%.

3.1.2 Analysis Prerequisite Test

The prerequisite tests for analysis in this research are normality test, homogeneity test, hypothesis test, and n-Gain score test. For more details, see table 5.

Table 5. Testing Results Test with Kolmogorov Smirnov

	Average	Standard Deviation	D_{hit}	K_{table}	Ket
Pre-Test	54,5	11,8	0,097	0,281	Normally distributed

Post-Test	82,5	12	0,033	0,281	Normally distributed

Based on Table 5, the results of normality test data processing show that for the initial value of the learning outcomes of students in class XI Science before laboratory learning, the value Dcalculated = 0.097. From the table listing the Kolmogorov Smirnov critical values at the 5% significance level, the Ktabel value = 0.281. It is known that the value of Dcount<Ktable or 0.0842<0.281. From the results of processing the normality test using Kolmogorov Smirnov, it can be stated that the learning results of students before learning in the laboratory are samples that come from a normally distributed population. Meanwhile, for the post-test results, the Dcount value = 0.033. From the table listing the Kolmogorov Smirnov critical values at the 5% significance level, the Ktabel value = 0.281. D=it is known that the value of Dcount<Ktable or 0.033<0.281. From the results of processing the normality test using Kolmogorov Smirnov, it can be stated that the learning outcomes of students after learning in the laboratory are normally distributed.

Table 6. Homogeneity Test of Student Learning Results

Group	F_{hitung}	F_{tabel}	Criteria
Pre-Test	2,38	2,97	Homogeneous
Post-Test	1,32	2,97	Homogeneous

Based on Table 6, processing with the F test, obtained F_count=2.38 while F_table= 2.97. This means that F_count<F_table or 2.38<2.97 with homogeneous criteria. Meanwhile, for the post-test, F_count=1.32 was obtained while F_table= 2.97. This means that F_count<F_table or 1.32<2.97 with homogeneous criteria.

Table 7. Hypothesis Testing with t-test

Group	t_{-count}	t_{table}	Information
Pre-test	-35,70	1,7247	Ho
Post-test			

Based on Table 7 of the data processing results above, it can be seen that t_count=-35.7023 and t_tabel=1.7247 with a significance level of 5% and dk = 22 - 1 = 21. It is known that t_count<t_tabel (-35.7023<1, 7247) so that Ho is accepted, meaning that there is an increase in student learning outcomes before learning in the laboratory and after learning in the laboratory.

Table 8. Gain Score Test Results

Class	Posttest	Pretest
$\bar{x}_{pre}$	82,5	54,5
Gain (g)	0,64	0,64
Information	Currently	Currently

Based on Table 8 of the data processing results, it can be seen that the average increase in student learning outcomes on the subject of Temperature and Heat was obtained with an average pretest score of 54.5 and an average posttest score of 82.5, resulting in a gain value of 0.64. Based on the description above, it can be concluded that the two classes have moderate gain criteria.

3.2 Discussion

3.2.1 *Students' learning motivation at SMA Negeri 6 Wangi-Wangi*

From the results of research conducted by researchers at SMA Negeri 6 Wangi-Wangi. Based on the results of calculations that have been carried out, a value was obtained for the learning motivation of students in class XI Science after conducting learning in the laboratory with an average value of 81.5. Then, when determining

the learning motivation category, 18 students were in the high category and 3 other students were in the medium category. Based on this explanation, it shows that the results of students' learning motivation in class XI Science. In the very high category there are 3 students, in the high category there are 14 students, in the medium category there are 2 students and in the low category there are 3 students. So it can be concluded that learning in the laboratory can increase students' learning motivation. In line with research conducted by (Hermana et al., 2022), the use of laboratories in learning can increase students' learning motivation.

In the learning process, problems that often arise can be overcome with several solutions that are appropriate to the conditions that occur in the field. In the process, a teacher must be able to provide more encouragement to students so that students can be motivated to participate in learning well and a teacher must be able to invite students to think critically about the relationship between phenomena that occur in everyday life and current learning. studied. Learning in the laboratory provides an interesting focus for students in developing authentic problem solving so that it can become a cognitive memory for the students themselves in meaningful learning (Emda, 2017).

Research result Lubis & Rizkika, (2017) is the effectiveness of using laboratories in biology learning. They conducted research on the effectiveness of using laboratories, while researchers conducted research on the use of laboratories to increase student motivation and learning outcomes. On the other hand, other research also found that there is effectiveness in the use of laboratories in a number of lessons at school (Darojat, 2022; Hidayat et al., 2023; Langngan et al., 2021). Based on these findings, the use of physics laboratories can be an effective learning strategy to increase student learning motivation. However, this success really depends on the readiness of schools, teachers and students themselves. Improving laboratory facilities, teacher training, and planning interesting experiments are important steps to maximize the positive impact of laboratory-based learning.

3.2.2 *Student Learning Results Before and After at SMA Negeri 6 Wangi-Wangi*

Before the learning process is carried out in class, students are given pre-test questions on Temperature and Heat material in class the. The research results show that student learning outcomes before learning in the laboratory have the lowest score of 30 and the highest score is 70 with the average score of student learning outcomes before learning in the laboratory in class XI Science is 54.5. From the data obtained, it can be explained that the average learning outcomes of students before learning in the laboratory are lower. Based on the results of the hypothesis test, the tcount value is smaller than the ttable value, so it can be stated that there is no significant difference in cognitive learning outcomes between before and after treatment. In this case, it means that the students' initial abilities before being given treatment show that the students' cognitive learning outcomes have the same abilities.

After carrying out the learning process in the laboratory in class This can be seen from the average results of student learning outcomes before being given treatment and after being given learning treatment in the laboratory. The results of this research show that students' learning outcomes in learning in the laboratory after being given treatment had the lowest score of 55 and the highest score of 100 with an average student learning outcome of 82.5. Meanwhile, after using the conventional model, it has the lowest score of 35 and the highest score of 75 with an average student learning outcome of 56.4. Based on the hypothesis test carried out, the data shows that tcount is greater than the ttable value or in other words there is a significant difference in the learning outcomes of class XI Science students.

This research is in line with a number of studies that have been conducted, which concluded that student knowledge competency data was obtained through posttests carried out after teaching and learning activities. The data obtained were analyzed using the Independent Samples T-test in Excel. The results of the analysis show that the average knowledge competency of experimental class students is better than that of the control class. This shows that the application of learning models in the laboratory accompanied by demonstration methods

in Physics subjects has an influence on student learning outcomes (Asma, 2021; Endayani et al., 2020; Rondonuwu et al., 2022; Sahempa et al., 2021).

Based on the explanation above, it can be concluded that the results of studying physics using learning in the laboratory can be categorized as good for use in subsequent lessons because it is able to improve the learning outcomes of students.

3. Conclusion

Based on the results of research at SMA Negeri 6 Wangi-Wangi, there was an increase in students' learning motivation after learning in the laboratory. This can be seen from the results of the student questionnaire that was distributed where the average value of students' learning motivation before learning in the laboratory was 68.72 and after learning in the laboratory the average value of students' learning motivation increased to 81.3.

After researchers conducted research at SMA Negeri 6 Wangi-Wangi, there was an increase in student learning outcomes after learning in the laboratory. This can be seen from the test results of the students which were distributed, where the average value of student learning outcomes before learning in the laboratory was 54.5 and student learning outcomes after learning in the laboratory, the average value of student learning outcomes increased to 82.5.

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