

# The Effect of Practicum Tools with Differentiated Learning Strategies on Student Learning Outcomes

Golberd H D Sinaga, Mariana Br Surbakti, Morianus Gowasa\*, Juliper Nainggolan, Hebron Pardede, & Parlindungan Sitorus

Department of Physics Education, Nommensen HKBP University, Indonesia

\*Corresponding Author: [morianus.gowasa@student.uhn.ac.id](mailto:morianus.gowasa@student.uhn.ac.id)

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**Abstract** - This study aims to determine the effect of using practicum tools with differentiated learning strategies on student learning outcomes. The research method used is quasi-experimental design. The population in this study was all of class X MIA, totaling 212 students, of SMA Negeri 8 Medan. The research sampling technique is purposive sampling technique. Non-equivalent control group design is the type of the research design. The sample in the study consisted of an experimental class, namely class X MIA 6, and a control class, namely class X MIA 5. The experimental class was treated with differentiated learning strategies, while the control class was treated with conventional learning. The research instruments used were multiple-choice questions and student observation sheets. The average score of the posttest for the experimental class was 76.28 with a standard deviation of 6.9, and that of the control class was 72.08 with a standard deviation of 6.7. The pretest and posttest data obtained have been analyzed and met the prerequisites for testing the hypothesis, namely, the data is normally distributed and is homogeneous. The result of the right-tailed  $t$ -test on the hypothesis obtained the value of  $t_{count} > t_{table}$ , namely  $2.608 > 2.002$  with  $\alpha = 0.05$ . Based on the testing criteria, the accepted hypothesis is  $H_1$ , which means that there is an effect of the treatment that is the use of practicum tool with different learning strategies on student learning outcomes at SMA Negeri 8 Medan for the 2022/2023 academic year. The result of the simple linear regression equation is  $Y = 65.9 + 0.34X$ .

**Keywords:** Practicum; Differentiated Learning; Student Learning Outcomes

## INTRODUCTION

Education, according to Chapter I Article I of The Regulation of The Government of The Republic of Indonesia Number 57 of 2021 concerning National Education Standards, refers to a conscious and planned effort to create conditions during the learning process so that students can actively develop their abilities to have personality, religious spirituality, noble character, self-control, intelligence, and skills needed by himself, society, nation and state.

Learning is a process that changes the potential and behavior of students, that is obtained through training and experience as stated by Nursalin (Laia et al., 2022). Meanwhile, Sudjana (Sitorus et al., 2022) defines learning as a process of effort made to obtain a whole new change in behavior,

habits and other aspects felt by someone who is learning. Changes in behavior through the learning process are called learning outcomes. A learning process has goals that must be achieved. Learning outcomes are a change in behavior in a person that can be observed and measured in the form of knowledge, attitudes and skills (Imron & Sahyar, 2019). Therefore, it can be concluded that learning outcomes are changes in behavior in the form of knowledge and abilities through the learning process.

Science is a subject taught at the SMA/MA (senior high school) level as a compulsory subject in class. Physics is one of the subjects that must be taught to senior high school students, especially to those who major in science. Nash said that physics is a way or method for observing nature

(Hernawati, 2018). Physics is a learning that objectively or quantitatively studies natural phenomena on an automatic scale and even the universe from various scientific ideas with various scientific research both in the form of inventions and designs. Physics is the origin of science that can develop other sciences or advanced and modern technology so as to facilitate individual activities.

The practicum term "practice" means real (activities carried out directly) in accordance with the subject matter of the discussion. Understanding practicum is part of teaching with the aim that students get the opportunity to test and implement in real life, what is obtained from theory and practical lessons. The Science Laboratory is one of the school facilities where teachers and students carry out science learning activities through practicum (Pane & Silaban, 2021). According to Winanda et al (Harijanto, 2018) the laboratory is an important facility that cannot be ignored. Physics laboratory is a place where experiments related to physics are carried out, which can be useful by providing understanding to students and cultivating a scientific attitude.

The researcher conducted interviews with the physics teacher, namely Ms. Rosiana and several students in class X MIA about the learning outcomes of the students. She said that students were less enthusiastic about learning activities and had difficulty doing the exercises given by the teacher. This situation indirectly affects the students' grade. Students consider physics learning as a learning that only focuses on formulas and hence is not interesting to learn. The physics laboratory in SMA Negeri 8 is fully equipped. However, obstacles and challenges remain to exist in the implementation of practicum in this school. One of the physics teachers stated that

students' scores during practicums were still low so that the implementation of practicums at schools was still very minimal.

Some of the factors that cause problems in learning physics are the use of conventional learning models without involving students directly in learning activities. This causes the students to think that learning physics is boring, and only focuses on formulas (therefore, not interesting to learn). Teachers often teach the students using the learning styles they need. Rarely do they think about the students. This hence results in the learning goals' not being achieved, which in turn indirectly affects the learning outcomes obtained by the students. Students learning outcomes are below the KKM (i.e., minimum completeness criteria), as evidenced by the results of the documentation study the researchers did with the physics teacher in class X MIA SMA Negeri 8 Medan. The results of the preliminary study showed that for the academic year of 2022/2023, the students were required to retake the final exams. Students do not master the use of practical tools. Practical activities carried out are boring as it used lecturing and was teacher-centered. This method is usually used at the beginning of the practicum as an introduction to the material to be studied. In addition, learning activities in the laboratory during the practicum process do not pay attention to the needs of students, including their learning styles.

Based on the problems stated above, it is necessary to find the right solution that can answer the various needs of the students. The appropriate solution in answering the needs of these students is implementing a differentiated learning strategy which prioritizes the diverse needs of the students.

Learning strategies are strategies used in learning, such as discussions, observations and questions and answers, as

well as other activities that can encourage the formation of student competencies as conveyed by Mulyasa (Nurdyansah & Toyiba, 2018). Helmiati (Nainggolan et al., 2021) stated that "learning methods are sequences, steps, procedures or methods used by a teacher to convey learning objectives. According to Haudi (Sitorus et al., 2022), a learning strategy is an action plan which includes the use of methods and the utilization of various resources/ strengths in a lesson.

According to Jusmawati (Laia et al., 2022), a differentiated learning strategy is a plan that contains activities (a series of exercises) intended to combine the use of strategies and the use of different assets and qualities in inventions that are structured to achieve certain goals. According to Marlina (Isrotun, 2022) differentiated learning basically consists of two stages: assessing the level of difficulty and suitability of the implemented lesson plans, and modifying, adapting, or creating new learning designs in response to students' needs, interests, and learning preferences. Differentiated learning can be defined as a way of recognizing and teaching according to the talents and learning styles of different students (Bendriyanti et al., 2021). Differentiated learning is very important to apply because each individual has its own uniqueness. Differentiated learning (differentiated instruction) is a good way to teach because it gives all students in a diverse classroom community a variety of ways to understand new information. In order that students from various backgrounds can learn effectively in one class, it is necessary to acquire content, manage, construct, or reason ideas, develop learning products, and develop assessment measures. According to Andini (Syarifuddin & Nurmi, 2022), learning is differentiated in terms of content, processes and products.

Differentiated learning is aimed at providing learning to students by paying attention to learning interests, learning readiness, and learning styles. According to Merlina in the journal (Faiz et al., 2022), in general, differentiated learning coordinates learning which emphasizes aspects of interest in learning, readiness in learning and preferences. So, this differentiated learning strategy is expected to be able to answer the needs of students in creating effective learning and having freedom in learning. Based on the background above, the researcher wants to conduct research with the title "The Effect of Using Practicum Tools with Differentiated Learning Strategies on Student Learning Outcomes". This study aims to determine the effect of using practicum tools with differentiated learning strategies on student learning outcomes in class X MIA SMA Negeri 8 Medan, academic year of 2022/2023.

## RESEARCH METHODS

The research method used in this research is experimental design (pseudo-experimental design). The quasi-experimental design used was the nonequivalent control group design, which can be seen in Table 1 below.

**Table 1.** *Nonequivalent Control Group Design*

Class	Pretest	Treatment	Posttest
I	X <sub>1</sub>	T <sub>1</sub>	X <sub>2</sub>
II	X <sub>1</sub>	T <sub>2</sub>	X <sub>2</sub>

With:

I = control class (X MIA 5)

II = experimental class (X MIA 6)

X<sub>1</sub> = pre-test

X<sub>2</sub> = posttest

T<sub>1</sub> = conventional learning strategy

T<sub>2</sub> = differentiated learning strategy

The population in this study were all students in class X MIA SMA Negeri 8 Medan, totaling 212 students. The type of sampling used in this study is purposive sampling technique. Here, class X MIA 5

serves as the control class while class X MIA 6 as the experimental class. The independent variable of the study is the learning strategy that differentiates the learning outcomes of students and the dependent variable is the learning outcomes of students.

The researcher used data collection in the form of cognitive questions. This takes the form of an objective test instrument consisting of 20 multiple choice questions—each with 5 different options. Each correct answer is given a score of 1 (one), and each wrong answer is given a score of 0 (zero). The results obtained will be processed by the researchers.

This test instrument was used first to collect research data by testing its validity and reliability as well as the feasibility of this instrument in collecting research data. Previous validity test items were used to collect research data. Valid test items will be used twice, namely during the pretest and posttest in the experimental and control classes while invalid test items will be discarded. The values obtained will be analyzed using the normality test, homogeneity test, and hypothesis testing.

The normality test used is the Lilliefors test. If  $L_{count} < L_{table}$ , with significant level of  $\alpha = 5\%$ , then the data is normally distributed. The homogeneity test of variance aims to determine whether the variances of the two groups are homogeneous or not.  $F_{count}$  has a denominator  $dk$  of  $(n - 1)$  and a numerator  $dk$  of  $(n - 1)$  with a significant level of  $\alpha = 0.05$ . After comparing the values of  $F_{count}$  and  $F_{table}$  with the test criteria,  $H_0$  is accepted if  $F_{count} < F_{table}$  and rejected if  $F_{count} \geq F_{table}$ . The two-tailed test was used to see that the initial abilities of the experimental and control classes were not significantly different. Then, the  $t_{count}$  is compared with

$t$  with  $dk = n_1 + n_2 - 2$  and an error level of 5%. The provisions applied is that if  $t_{count} \leq t_{table}$  then  $H_0$  is accepted, if  $t_{count} > t_{table}$  then  $H_0$  is rejected.

The stages of implementing research activities carried out by researchers are: making observations, testing test instruments, mapping students from the results of diagnosis assessments based on learning styles in experimental classes, giving pretests, giving treatment with learning strategies, giving posttests, and analyzing the results of research data.

## RESULTS AND DISCUSSION

### Results

The test instrument was tested on students in class XI MIA 2 SMA Negeri 8 Medan. The validity of the test instrument items has been tested using product moment correlation. Test items that have been tested are 25 questions with the number of testees = 34 people,  $\alpha = 0.05$  then  $r_{table} = 0.339$ . The results of the validation test suggested that there were 20 questions with a Pearson Correlation value  $> 0.339$ , thus 20 questions were valid questions and 5 questions were invalid. The results of the test instrument's reliability test obtained an  $r_{count}$  value of 0.98, with the results of a reliable value. Hence, 20 questions will be used for reliability and are classified as very high.

The pretest data were processed before the students were given treatment in the form of learning strategies. The posttest results were processed after the students were given treatment in the form of learning strategies. The normality of the pretest and posttest data was tested using Lilliefors test. Here, the results of the normality test can be seen in Table 2.

**Table 2.** Summary of Lilliefors Normality Test Results

Class	N	Lcount		Ltable	Conclusion
		Pretest	Post-test		
Control	36	0.178	0.120	0.150	Normal
Experimental	35	0.134	0.140	0.148	Normal

Based on the results above, the normality test ( $L_{count} < L_{table}$ ) obtained a value of  $0.149 < 0.150$  for the control class and  $0.137 < 0.148$  with  $\alpha = 0.05$  for the experimental class. Therefore, it can be concluded that the data obtained is normally

distributed. Hence, the data has fulfilled the normality requirement to test the research hypothesis.

The homogeneity test for the control and experimental class's pretest and posttest data can be seen in the following table.

**Table 3.** Summary of Variance Homogeneity Test Results

Data	Group		Fcount	Ftable	Conclusion
	Control	Experimental			
Pretest	147.67	142.68	1.03	1.84	Homogeneous
Posttest	44.81	47.56	0.94	1.84	Homogeneous

Based on the table above, the results of the homogeneity test for the control and experimental classes obtained  $F_{count} < F_{table}$  with  $\alpha = 0.05$ . It can be concluded that the variance of the pretest and posttest data is homogeneous. Therefore, the data has

fulfilled the homogeneity requirement to test the research hypothesis.

Data on the results of the research hypothesis testing can be seen in the following table.

**Table 4.** Hypothesis Testing Results

Data	Average		Tcount	Ttable	Conclusion
	Control	Experimental			
Pretest	45.42	46.57	0.402	2.002	Homogeneous
Posttest	72.08	76.28	2.608	2.002	significant value

Based on the results of the calculation of the two-party research hypothesis testing, the value of  $\alpha = 0.05$  and the  $t_{count} < t_{table}$  is  $0.402 < 2.002$ . Therefore,  $H_0$  are accepted and  $H_a$  is rejected.

**Discussion**

This research was carried out in class X MIA SMA Negeri 8 Medan. The results of research data analysis that have been carried out show that there are differences in the learning outcomes (in the form of mean/average) of the students of the control and the experimental class. This observation sheet is used by researchers to view and

observe learning activities using differentiated learning strategies. In this observation sheet, treatment was only given twice in the experimental class. After the first treatment, the students obtain an average score of 64.88, and after the second treatment, 76.82. Therefore, overall, the students obtain an average score of 70.85. The mean score for the control class and the experimental class are 72.08 and 76.28; the standard deviation values for the control and experimental classes are 6.7 and 6.9, and the variance values for the control and experimental classes are 44.81 and 47.56.



The normality test was carried out to determine whether the samples taken from this research population were normally distributed or not. The normality test for the pretest and posttest data was done using the Lilliefors test. The results of the normality test for the control class' pretest and posttest data were  $L_{count} = 0.178$  and  $0.120$ . The results of the normality test for the experimental class' pretest and posttest data were  $L_{count} = 0.134$  and  $0.140$ . So, in total, the  $L_{count}$  for the control class are  $0.149$  while the total  $L_{count}$  for the experimental class are  $0.137/2 = 0.137$ . Meanwhile, the  $L_{table}$  for the control class is:  $L_{table} = 0.886/\sqrt{36} = 0.150$ , and the  $L_{table}$  for the experimental class is  $L_{table} = 0.886/\sqrt{35} = 0.148$ .

Based on the results above, the results of the normality test value— $L_{count} < L_{table}$ — are  $0.149 < 0.150$  for the control class and  $0.137 < 0.148$  for the experimental class with  $\alpha = 0.05$ . Therefore, it can be concluded that the data obtained is normally distributed. Hence, the data has fulfilled the normality requirement to test the research hypothesis. The homogeneity test aims to determine whether the data obtained has a homogeneous variance or not. The results of the pretest data homogeneity test are:  $F_{count} = 1.03$ . Then, the value of  $F_{count} < F_{table}$  is obtained, namely  $1.03 < 1.84$ . Thus, it is concluded that the two variances of the pretest data are homogeneous. The results of the posttest data homogeneity test are:  $F_{count} = 44.81/47.56 = 0.94$ . Then, the value of  $F_{count} < F_{table}$  is obtained, namely  $0.94 < 1.84$ . Thus, it is concluded that the two posttest data variances are homogeneous. The test of homogeneity in the control and experimental classes obtained a value of  $F_{count} < F_{table}$  with  $\alpha = 0.05$ . Thus, it can be concluded that the variance of the pretest and posttest data is homogeneous. Hence,

the data has fulfilled the homogeneity requirement to test the research hypothesis.

After conducting the normality and homogeneity test, it was discovered that both classes were normally and homogeneously distributed. The results of the pretest data hypothesis test are:  $t = 0.402$ . Then, the results of the two-party research hypothesis test calculation show that the value of  $\alpha = 0.05$  with  $t_{count} < t_{table} = 0.402 < 2.002$ . Therefore,  $H_0$  is accepted and  $H_a$  is rejected. The results of the posttest data hypothesis test are  $t = 2.608$ . Then, the research hypothesis test on the right side shows that the value of  $\alpha = 0.05$  with  $t_{count} > t_{table}$  of  $2.608 > 2.002$ . Therefore,  $H_0$  is rejected and  $H_a$  is accepted. This means that there is a significant difference between the mean/average score of the learning outcomes of the control and experimental classes.

$$H_a : \mu_1 > \mu_2$$

Therefore, it can be concluded that there is an influence of differentiated learning strategies on the learning outcomes of class X MIA students at SMA Negeri 8 Medan for the 2022/2023 academic year.

To determine the value of the influence of differentiated learning strategies on student learning outcomes, the study used a simple linear regression mathematical equation. Simple linear regression test with X value:  $1.084,25$  and Y value:  $2.670$ .

Based on the data from simple linear regression analysis, the equation  $Y = 65.9 + 0.34X$  with a constant value of  $a = 65.9$  shows that if variable X increases by 1 unit, the students' learning outcomes will increase by  $0.34$ . The positive direction shows that student learning outcomes in harmonious vibration material in class X MIA SMA Negeri 8 Medan for the 2022/2023 academic year will increase with the influence of differentiated learning strategies.

## CONCLUSION

Based on the results of the research and testing carried out, namely, the right-tailed t-test hypothesis test with  $t_{count} > t_{table}$  value of  $2.608 > 2.002$ ,  $H_0$  is rejected and  $H_a$  is accepted. Furthermore, there is 59% increase in the results of the posttest scores for the control class, and 64% for the experimental class. The results of the field observation sheet also increased by 52%. The value of the linear regression equation shows that variable X has a value of zero and the coefficient value of the linear regression direction increases by 1 unit. From the results of this test, it can be concluded that the use of practical tools with differentiated learning strategies has a significant effect on students' learning outcomes.

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