



The Effect of Differentiation Learning Strategies on Student Learning Results

Parlindungan Sitorus^{1*}, Eka Notasya Simanullang¹, Andriyono Manalu¹, Indah Septa Ayu Laia¹, Riossala Marselina Tumanggor¹, Juliper Nainggolan¹

¹Physics Education, HKBP Nommensen University, Medan, North Sumatra, Indonesia

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Corresponding Author:
Parlindungan Sitorus
parlindungan.sitorus@uhn.ac.id

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Abstract: The research conducted in the even semester of the 2021/2022 academic year aims to see how the influence of different learning strategies on the learning results of eighth-grade students of State Junior High School 4 Medan on vibration and wave material. This study used true experimental research with a pretest posttest control group design. The population used in this study was class VIII of State Junior High School 4 Medan as a whole consisting of 346 people. The sample of this study was class VIII-2 as the experimental class and VIII-3 as the control class selected using the cluster random sampling technique. To find out student learning results, multiple-choice questions with a total of 20 items have been previously tested for validity, reliability, difficulty, and discrimination. The learning results of the two classes were tested for normality with the Lilliefors test and the homogeneity test using the F test. Then a one-sided t-test was carried out for $\alpha = 0.05$, obtained $t_{\text{count}} = 2.07 > t_{\text{table}} = 1.6697$. As for the regression test obtained $= 15.79 + 0.78X$. Based on the results of the study, it can be concluded that there is an influence of differentiation learning strategies on the learning results of grade VIII students of State Junior High School 4 Medan.

Keywords: Different Learning Strategies; Learning Results; Students

Introduction

Education is a learning process where students are expected to be able to think and understand what they have learned well (Dwianti et al., 2021). Education is one of the supports that can determine the progress or not of a nation. If the quality of education is good, it will have a good impact on a nation. On the other hand, if the quality of education is poor, it will also have a bad impact on the nation. Quality education will give birth to innovative, creative things and produce better things from generation to generation. Indonesia as a developing country should pay more attention to the field of education.

The quality of education can be seen in the learning system. Learning is a teaching and learning process by teachers and students that aims to achieve learning success (Maasrukhin & Ratnasari, 2019). The learning process is said to be successful if there is a good change in students (Fakhrurrazi, 2018). In learning activities, the main focus is the interaction between teachers and students who have a common goal of obtaining learning.

Currently, the world of education is faced with a diversity of students, more difficult learning materials, and higher demanded learning results. Teachers must be able to improve their competence in teaching, choose learning strategies and manage class activities effectively so that the learning carried out can run well.

Physics is one of the learning in schools that studies natural phenomena and symptoms. Physics is a field of science that provides knowledge about the universe using reasoning and thinking. In learning physics, students are required to understand various theories, principles, and concepts and be able to solve various problems and solve problems. Students are also required to have the ability to think critically to identify problems, process problems, and infer problems that exist in learning so that the expected learning objectives are obtained. Teachers are expected to involve students to be active and creative in learning so that the learning process runs well according to educational objectives (Surbakti et al., 2021).

The selection of appropriate learning strategies will affect student learning results. Learning Results are

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changed in student behavior that occurs after the learning process activities (Sani, 2019). Learning results can also be used as a reference or comparison of how students change from before and after learning (Magdalena et al., 2021). This learning result is also the final assessment obtained from the learning results.

To be able to improve student learning results, teachers are expected to be able to choose the latest, active and innovative learning strategies or ways. One of the things is differentiated learning strategies. Differentiated learning strategies are learning strategies that are carried out in various ways and vary according to the needs of students. This differentiated teaching strategy can help students in obtaining good learning results because students learn according to brand interest and are centered on analyzing the needs of learners (Setiyo, 2022). The role of the teacher is very important in collaborating on the strategies, models, and methods needed in designing learning.

Learning is a process of seeking knowledge. Learning is not only limited to doing assignments and exams but rather changes in student behavior as a result of the learning process (Setiawati, 2018). In the learning process, changes in student behavior are learning results consisting of cognitive, affective, and psychomotor aspects (Sani, 2019). Many factors can affect high and low learning results including the influence of teachers, friends, the environment, parents, and even learning strategies used by a teacher (Sitorus et al., 2021).

A strategy is a form of plan or design to achieve a goal. According to (Fatimah & Sari, 2018) strategy is a technique used to achieve a goal. Meanwhile, according to Abdullah & Azis, (2019) strategy is a design of activities or actions that are deliberately arranged for a specific purpose. Based on the above opinion, it can be concluded that strategy is a technique or design that is carried out to achieve certain goals.

Learning is a way or process to make a person learn. Learning can also be interpreted as a learning activity carried out by teachers and students in a place to achieve certain goals (Suardi, 2018). Differentiation comes from the word differentiation. According to the Big Indonesian Dictionary (known with KBBI), the word differentiation means differentiation. Then it can be concluded that differentiated means varied, diverse, different, and not the same.

Differentiated learning is learning that allows for different teacher treatment of each student. In this learning, the main focus is caring for students by paying attention to their needs of students. This is in accordance with the educational philosophy according to Ki Hajar Dewantara who said that teachers must be able to guide students to develop according to their nature (Ainia, 2020) so that teachers must be able to guide and guide students in learning according to the child's nature. In this differentiated learning, the teacher's attention and concern for the learning needs of students are very important and become the main goal of learning (Sitorus et al., 2022).

In Module 2.1 of the Mobilizing Teacher Program, it is stated that differentiated learning is learning carried out by teachers and is student-centered (Faiz et al., 2022). In this case, the teacher seeks to develop a learning strategy centered on the needs of the students. In this case, creative and innovative teachers are needed so that they can guide students to learning success.

From some of the opinions above, it can be concluded that differentiated learning strategies are learning strategies that focus on student learning needs in terms of learning readiness, interests, and student learning profiles so that learning objectives can be achieved properly. Differentiation strategies are efforts made in the implementation of differentiated learning by paying attention to teaching activities that can help students learn according to their needs and learning profile (Bayumi et al., 2021)

There are 3 (three) differentiation strategy activities that can be carried out, including:

1. Content Differentiation

Differentiation of the content is a learning strategy prepared by the teacher by distinguishing students in the delivery of content in the form of learning material to be learned. This content differentiation is related to the material or subject content that will be taught to students by paying attention to mapping student learning needs such as student learning profiles, readiness, and student learning interests.

2. Process Differentiation

Process differentiation is a learning strategy prepared by teachers by distinguishing students in the learning process that each undergoes to acquire knowledge. In this activity, teachers must pay attention to how the right methods and techniques will be used in learning so that the learning process can run well. Students can be guided in a group or independent way according to the student's learning needs.

3. Product Differentiation

Product differentiation is a learning strategy prepared by teachers by distinguishing student learning results according to student readiness. The product referred to in this case is the result of student work from the material being studied such as writing, videos, recordings, written works, and other works related to learning materials.

Tomlinson said that the mapping of student learning needs is based on 3 (three) aspects, namely learning readiness, student interests, and learning profiles of the student (Bayumi et al., 2021). In this study, what was used emphasized more on the student's learning profile in the form of learning styles. This is so that students can learn naturally and efficiently because they learn based on their needs. This means that in this case students learn from what they see and hear which will be stored in their memory, then it will have an impact on their learning results so that the child can think and react. Sometimes teachers tend to choose a learning style that suits the teacher regardless of the difference in the student's learning profile. In fact,

teachers need to vary teaching methods and strategies according to student needs so that learning objectives can be achieved properly.

There are three types of learning styles, including Hasanah et al., (2018): (1) Students with a visual learning style are students whose learning style prioritizes vision, observation, and analysis. In the learning process, students are given content or subject matter in the form of summaries, concept maps, and materials containing images, tables, and diagrams that allow students to learn by looking and observing. The material presented is better to use colors, shapes, and images that can attract the attention of students in learning; (2) Students with an auditorial learning style are students whose learning style prioritizes hearing to obtain information and knowledge. In the learning process, students are given content or subject matter in the form of learning videos that contain explanations of the material equipped with the sound that allows students to learn by hearing; (3) Students with a kinesthetic learning style are students whose learning style prioritizes physical activity or direct involvement by moving and doing things. In the learning process, students are given content or subject matter in the form of a material gallery that is pasted in front of the class so that students can find and collect knowledge from the subject matter doing physical activity or hands-on practice. By learning while practicing directly, students will understand better because they get direct experience from what they learn. Students with this learning style tend not to be able to stay in class or seating for quite a long time.

Method

This research was conducted in the eighth grade of State Junior High School 4 Medan in the School year 2021/2022. Theelitezation is carried out in the even semester, namely May to June, with as many as 4 meetings with the time allocation for each meeting being 2 x 40 minutes. In this study, the population was all grade VIII students of State Junior High School 4 Medan in School year 2021/2022 consisting of 11 classes with a total number of students of 346 people.

The sampling technique used in this study was cluster random sampling, which means randomizing groups, not individual subjects. From the 11 population classes, the researcher will randomly select 2 classes that will be used as experimental classes and control classes. In this study, a sample of the experimental class was obtained, namely class VIII-2, totaling 32 people who would be taught using differentiated learning strategies. While the control class is class VIII-3, of which 32 people will be taught using conventional learning strategies. Before being given treatment, a learning style questionnaire was first given to the experimental class to examine the student's learning styles consisting of visual, auditorial, and kinesthetic groups.

This research is a type of true experimental design (real experiment) research with a pretest-posttest control

group design research design. The design of this study is seen in the table below.

Table 1. Pretest-Posttest Control Group Design

Class	Pretest	Treatment	Posttest
Experiment	P ₁	Q ₁	P ₂
Control	P ₁	Q ₂	P ₂

Information:

P₁ : Pretest

P₂ : Posttest

Q₁ : Differentiated learning strategies

Q₂ : Conventional learning strategies

Results and Discussion

Differentiated learning is learning that is oriented toward the needs of students. In this study, students were grouped based on their respective learning styles. Each student has a different learning style so the teacher is required to teach according to the characterization of the students he faces (Kurniati et al., 2019).

The learning styles used include visual, auditorial, and kinesthetic learning styles. In their research, (Azis et al., 2020) stated that visual learning style is a type of learning style by looking and observing, auditorial learning style is a type of learning style by listening and kinesthetic learning style is a type of learning style by doing. Learning styles have an important role in learning activities. The use of appropriate learning styles will help students in the process of seeking knowledge and knowledge. The learning process must be carried out in the way of the students themselves so that they will get maximum results.

In this study, the results of the research data obtained were the learning results of students during learning. Before the learning is carried out, a pretest is first given to the experimental class and the control class to know whether the initial abilities of the students of the two classes are. Along with the provision of pretests in the experimental class, a learning style questionnaire was also given to group student learning styles, namely, visual, auditorial, and kinesthetic.

The results of the analysis of the learning styles of experimental class students based on the learning style questionnaire produced as many as 41% of visual learning styles, 31% of auditorial learning styles, and 28% of kinesthetic learning styles. Thus, the tendency of the learning style of the students of the experimental class is dominated by the visual learning style shown in Table 2 and Figure 1.

Table 2. Percentage of Learning Styles of Experimental Class Students

Learning Styles	Sum	Percentage (%)
Visual	13	41
Auditorial	10	31
Kinesthetic	9	28

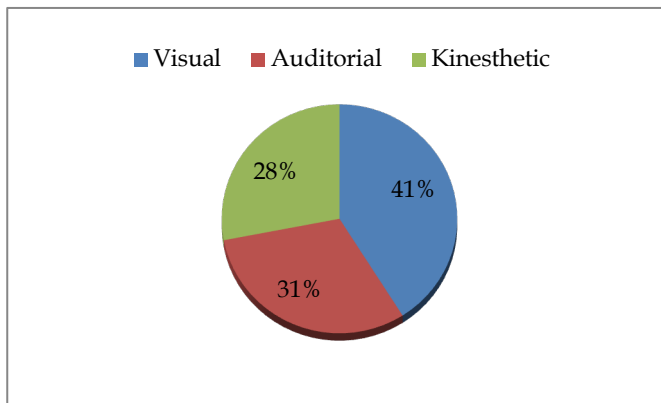


Figure 1. Percentage Diagram of Learning Styles of Experimental Class Students

Based on the results of the study, student scores were obtained based on their learning styles as follows:

Table 3. The Average Value of Students Based on Learning Styles

Student Learning Styles	Average
Visual	68.08
Auditorial	71.50
Kinesthetic	75.00

Based on the data in fFigure 2, visual learning styles have an average of 68.08, auditorial learning styles have an average of 71.50 and kinesthetic learning styles have an average of 75.00. Thus, kinesthetic learning styles have a greater value than students' scores using visual and auditorial learning styles.

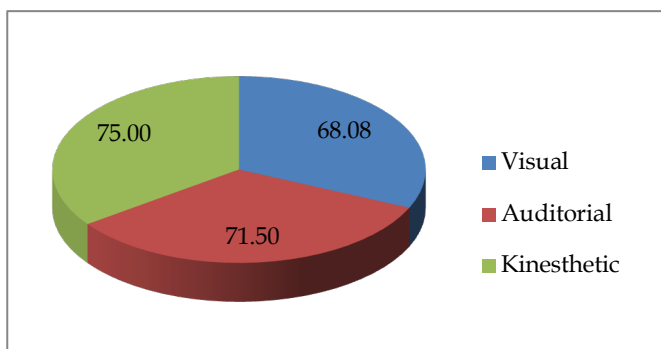


Figure 2. Diagram of Student Average Scores Based on Learning Styles

Pretest

Table 4. Pretest Data

Class	Value		Mean
	Min	Max	
Experiment	15	60	36.88
Control	20	65	37.66

Based on Table 4, it can be seen that the mean value or average of the experimental class is an average of 36.88 while the control class has an average of 37.66. The average deviation of the two classes is 0.78 and from the data, it can be concluded that the initial abilities of the two classes are relatively the same.

Posttest

Table 5. Posttest data

Class	Value		Mean
	Min	Max	
Experiment	50	85	71.09
Control	50	80	66.09

Based on Table 5, it can be seen that the experimental class obtained an average score of 71.09 while the control class obtained an average score of 66.09. From these data, it was concluded that experimental classes that used differentiated learning strategies had higher average scores than control classes that used conventional learning strategies. For more details, consider the following chart.

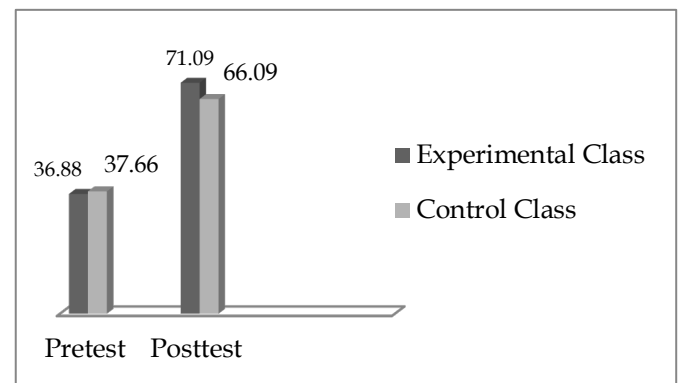


Figure 3. Pretest and Posttest Data Graphs

Based on Figure 3, it can be seen that the pretest value of the experimental class is 36.88 and the control class is 37.66. In the pretest data, the control class obtained a higher average score. Meanwhile, in the posttest value, it can be seen that the experimental class obtained a score of 71.09 and the control class 66.09. On the post-test data the highest score was obtained, experimental class. Before conducting further analysis, a prerequisite test is first carried out. The prerequisite tests carried out are as follows

Normality Test

To test whether the sample is normally distributed, the Lilliefors test is used. The criterion of testing normality is $L_{count} < L_{table}$.

Table 6. Normality Test Summary

Data	Class	L_{count}	L_{Table}	Conclusion
Pretest	Experiment	0.1300	0.1566	Usual
	Control	0.1457	0.1566	Usual
Posttestt	Experiment	0.0838	0.1566	Usual
	Control	0.1037	0.1566	Usual

Based on Table 6 obtained L_{count} pretest count of the experimental class and the control class is 0.1300 and 0.1457. For L_{count} posttest count of the experimental class and the control class is 0.0838 and 0.1037. While the L_{table} in the control class and experimental class is 0.1566. Based on these data, it is known that the price of $L_{counts} <$

L_{table} which means that the sample pretest and posttest data are normally distributed.

Homogeneity Test

To find out whether the data used are from a homogeneous population, a homogeneity test is carried out with an F test. The criterion of homogeneously testing is $F_{count} < F_{table}$.

Table 7. Homogeneity Test Summary

Data	Class	Variant	F_{count}	F_{table}	Conclusion
Pretest	Experiment	117.34	1.42	1.82	Homogeneous
	Control	166.10			
Posttest	Experiment	101.18	1.19	1.82	Homogeneous
	Control	85.06			

Based on Table 7 obtained F the pretest and posttest F_{count} for both classes are 1.42 and 1.19. While the F_{table} of the pretest and posttest tables in both classes is 1.82. From these data, the price of $F_{count} < F_{tables}$ in both classes was obtained, which means that the samples used in this study came from homogeneous populations.

Test the Hypothesis

a. *Pretest Hypothesis Test*

The pretest hypothesis test was carried out using a t-test of two side which aimed to see if the two sample classes had similarities in initial learning ability. The criterion of hypothesis testing using a two-party t-test is $t_{count} < t_{table}$ then H_0 is accepted and H_a is rejected.

Table 8. Hypothesis Test Summary for Pretest Data

Data	\bar{x}	t_{count}	t_{table}	Conclusion
Pretest Experiments	36.88	-0.26	1.9994	H_0 accepted
Pretest Control	37.66			

Based on Table 8 obtained hypothesis calculation $t_{count} = -0.26 < t_{table} = 1.9994$ for $\alpha = 0.05$ meaning that the experimental class and the control class had the same initial ability before being given different treatments.

b. *Test the Posttest Hypothesis*

The post-test hypothesis testis carried out using a t-test of one side which aims to determine whether there is a significant influence on the learning results of students using a differentiated learning strategy. Hypothesis testing criteria using one-party t-test if $t_{count} > t_{table}$ then H_a is accepted and H_0 is rejected.

Table 9. Hypothesis Test Summary for Posttest Data

Data	\bar{x}	t_{count}	t_{table}	Conclusion
Posttest Experiments	71.09	2.07	1.6697	H_a Received (There is Influence)
Posttest Control	66.09			

Based on Table 9 obtained hypothesis calculation $t_{count} = 2.07 > t_{table} = 1.6697$ for $\alpha = 0.05$ then H_a is accepted

and H_0 is rejected. Thus, it can be concluded that there is a differentiation of learning strategies for student learning results in vibration and wave material in class VIII of State Junior High School 4 Medan.

Simple Regression Test

To see the magnitude of the influence between differentiated learning strategies and the learning results of class VIII students on vibration and wave material at State Junior High School 4 Medan, a simple regression test was used. Regression tests can be known through simple linear regression mathematical equations $\hat{y} = a + bX$. Grades a and b can be obtained using student posttest data with student activity data during learning using differentiated learning strategies in experimental classes with the following formula.

From the data obtained the regression equation is $\hat{y} = 15.79 + 0.78X$. The coefficient X or value b is 0.78 which means that student activity has increased positively and if student learning activity b increases by one unit, student learning results will increase by 0.78. In this case, it is obtained that student learning activities affect student learning results which are indicated by the increase in student learning activities will affect student learning results as well. Based on these data, it can be concluded that differentiated learning strategies affect the learning results of class VIII students of State Junior High School 4 Medan.

This study uses an experimental type of research to see if there is an influence of differentiated learning strategies on student learning results. This study used two classes, namely the experimental class and the control class.

The experimental class is a class that applies differentiated learning strategi, namely class VIII-2. In this case, learning is student-centered because students are actively involved in seeking and accumulating knowledge from the learning process. The teacher will serve as a facilitator and guide the students in the learning process. Before implementing differentiated learning strategies, a pretest is carried out to find out how the student's initial abilities are before treatment. Along with the pretest, a questionnaire of student learning styles will also be distributed which will be filled out by students to determine groups based on their learning styles. The learning style questionnaire that is distributed first is validated to experts in their fields. The questionnaire of learning styles that have been filled in by students will be processed by the researchers to determine what learning style each student is.

After the learning style group data is obtained, learning is then carried out according to the Learning Implementation Plan. At the beginning of learning, students are divided based on groups of learning styles that have been filled in by previous students and processed by researchers. Once grouped, students are directed and given instructions on the implementation of learning. The first material taught was about vibration. For the differentiation of the content,

researchers share teaching materials according to their respective learning styles and for the differentiation of the process, each group will collect learning materials in different ways.

For the visual group, teaching materials are presented in the form of summaries containing concept maps, drawings, diagrams, and tables that allow students to learn by seeing and observing. In this activity, students will seek and collect knowledge from the material they have obtained based on the summary, concept map, drawings, and tables that have been provided.

For the auditorial group, teaching materials are presented in the form of learning videos containing vibrational material. The learning videos provided allow students to learn by listening. Students will collect the material they obtained from the learning videos as well as take notes in their respective notebooks.

For the kinesthetic group, teaching materials are presented in the form of a gallery of materials affixed to the front of the class. The material gallery will be visited by students of a kinesthetic group that allows them to learn while moving or doing physical activity. In this case, they will collect the materials they have obtained and record them in their respective records. The teacher will guide and supervise the learning process so that it runs conducive.

After all the groups have finished collecting material on vibrations, the teacher then distributes student worksheets to each group. The student worksheet distributed will be filled in according to the instructions. In this case, the kinesthetic group will carry out a practicum regarding a simple swing in front of the class along with the filling of the student worksheet. Meanwhile, the visual and auditorial groups will fill out the student worksheet while observing and listening to the process of practicum implementation carried out by the kinesthetic group.

After all the groups have finished filling out the student worksheet according to the instructions, then each group representative will present the results of their respective discussions in front of the class and conclude what they have obtained from the results of the discussion. The teacher will give appreciation to each group and correct what is still lacking. As material for evaluation, students are given questions that must be done to increase students' knowledge about the material being studied. Before the learning ends, the teacher together with the students concludes what has been learned and the teacher delivers the next material to be studied, namely the wave.

At the next meeting, the material to be studied is a wave. Like the previous meeting on the vibration material, the learning process carried out is also the same according to the learning implementation plan. Students will be divided into three groups based on their learning styles. Students will be given teaching materials according to their learning style and collect and record the material they have obtained. After that, each group

fills in the student worksheet according to the instructions provided. For the kinesthetic group, they will carry out wave material practicum using rope and a slinky while filling out the student worksheet. For visual and auditorial groups, they will fill out the student worksheet while observing and listening to the process of practicum implementation. The results of the discussion obtained will then be presented. At the end of the lesson, teachers and students will conclude the teaching material. In addition to product differentiation, teachers give assignments that will be worked on at home according to the student's learning style.

Meanwhile, for the control class, namely class VIII-3, different learning will be carried out. At the first meeting, a pretest will be held to see what the students' initial abilities are. After the pretest results are obtained, it will then be given treatment in the form of conventional learning. In this case, learning is centered on teachers and students as listeners only. For the first matter is vibration and the second matter is wave. The teacher will teach material about vibrations and waves by giving an explanation in front of the class. Learning is carried out only one way so that students are less actively involved in learning. After all the material explanations are presented by the teacher, they will then be given tasks for each student to do as evaluation material.

After the learning in the experimental class and control class is completed, the next step that is carried out is the implementation of the posttest. This aims to see how students are ability after being treated in the form of different learning strategies. The result of the posttest is processed and then compared to which learning strategy is more influential and better used in learning.

This differentiated learning strategy has a significant effect in improving student learning results because this learning strategy requires students to be active in seeking knowledge according to their respective learning styles. In the learning process, students learn based on their respective groups of learning styles that are guided directly by the teacher. This differentiated learning concentrates learning on the needs of students and students are taught according to their respective natures according to the opinion of Ki Hajar Dewantara (Dofir, 2020).

This research is also in accordance with the findings of previous researchers (1) (Iskandar, 2021) that differentiated learning improves the learning results of students in class IX.A of State Junior High School 1 Sape, (2) (Kamal, 2021) that the application of differentiated learning increases the activities and learning results of students of class XI MIPA SMA Negeri 8 Barabai and (3) (Suwartiningsih, 2021) that the application of differentiated learning improves the learning results of Class IX-B students of State Junior High School 4 Monta. Based on some of the results of the research above, it can be concluded that this differentiated learning strategy has an influence on student learning results.

Researchers in applying differentiated learning strategies in experimental classes have difficulties because students have not adapted to the learning strategies used. Learners are used to using conventional learning strategies with teacher-centered learning. In this learning strategy, students must be able to learn independently or in groups according to their respective learning styles and teachers play a role in guiding and supervising students in the learning process so that learning objectives can be achieved. Although it is still unfamiliar to learners, the differentiated learning strategies used in experimental classes are still better than conventional learning strategies in control classes.

Conclusion

Based on the data from the study results obtained the t-test value of one party of hypothesis calculation with $t_{\text{count}} = 2.07 > t_{\text{table}} = 1.6697$ and simple regression test results $\hat{y} = 15.79 + 0.78X$. Thus, it can be concluded that differentiated learning strategies have a positive influence on the learning results of class VIII students of State Junior High School 4 Medan on vibration and wave material.

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