

Differentiated Learning as an Effort to Improve Students Learning Outcomes in Physics Subjects

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Abstract

Differentiated learning refers to a learning approach where teachers can adjust teaching methods to take into account individual differences in the class. Differentiated learning has become the main focus in today's flexible learning and assessment processes, both for teachers and students in the classroom. This research was conducted with the aim of exploring the implementation of differentiated learning and digging more deeply into its impact on student learning outcomes at SMA Negeri 1 Selakau in Physics subjects. The results obtained were an average pre-test value of 43.14 and an average post-test value of 76.71 with a sig level. 0.000 through the Paired Samples T-test so that there is a significant difference in the pre-test and post-test results in differentiated learning in physics subjects in class XF with a sample population of 35 people showing an increase of 33.57. Therefore, this differentiated learning is highly recommended to be implemented by teachers at the Senior Secondary School level in all subjects so that student learning outcomes can improve because it is well facilitated according to each individual's unique character.

Keywords: Differentiated Learning, Learning Outcomes, Physics

INTRODUCTION

According to Ki Hajar Dewantara, education is to guide all the natural powers that exist in children, so that they as humans and members of society can achieve the highest safety and happiness. As teachers, we must realize that each child is unique and has his or her own nature. Our job as teachers is to facilitate a learning environment that allows each child to grow and develop optimally according to their individual nature, and to ensure that in the process, these children feel comfortable.

The concept of differentiated learning is a good concept and ideal to apply, but it is a challenge for teachers to be creative. With differentiated learning, students' potential is developed according to their needs, characteristics, and level of achievement. However, to achieve learning that is in accordance with this concept, teachers must be reliable facilitators, it requires struggle and hard work. Achieving educational outcomes in the curriculum and character education and differentiated learning is an ideal achievement. The question for educators is whether this can be realized and how to make it happen.

Every student in our class is a unique individual, who has a different character and personality. This should be the basis for the learning practices that we carry out and develop in the classroom and at school, as well as being a frame of reference when evaluating our learning practices. By believing that every child is unique, we as educators must open our eyes to the diversity of students in our class, so we need to think about how we can facilitate all this diversity and provide the best learning environment and experience for them.

Differentiated learning (differentiated instruction) is a teaching and learning process where students can learn subject matter according to their abilities, likes and individual needs so that they do not get frustrated and feel like they have failed in their learning experience (Magee, 2010). According to (Marlina, 2019), differentiated learning is an adjustment to students' interests, learning preferences, and readiness in order to achieve increased learning outcomes. In differentiated learning, teachers must use various methods when studying a lesson.

Differentiated Learning Objectives

Differentiated learning aims to increase all the potential that students have in accordance with their learning readiness, interests, and learning profile. With differentiated learning, students have the freedom to learn according to their talents and abilities. According to (Marlina, 2019) Differentiated learning has several objectives, namely:

1. To help students in learning. Teachers facilitate all students to achieve learning goals
2. To increase motivation and improve student learning outcomes. Teachers can motivate students by providing learning stimuli so that learning outcomes increase.
3. To establish a harmonious relationship between teachers and students. Establishing a harmonious relationship makes students more enthusiastic about learning.
4. To help students become independent learners. Stimulate students to be independent and have an attitude of respecting differences.
5. To increase teacher satisfaction. Teachers feel challenged to develop their teaching abilities and be more creative and innovative.

Aspects of Differentiated Learning

Within each child, there are characteristics and potential that are different from each other that teachers must pay attention to. According to (Tomlinson, CA, & Moon, 2013) There are 3 aspects in implementing differentiated learning to map student learning needs, namely:

- a. Readiness to learn (readiness) is the capacity to learn new material. An assignment to consider a student's level of readiness will take the student out of their comfort zone.
- b. Student interests. Interest is one of the motivators for students to be actively involved in the learning process. Student interests refer to things that attract attention, and curiosity and involve students.
- c. Learning profile. The learning profile is to provide opportunities for students to learn naturally and efficiently. Learning profile refers to the approach or method that students like most so that they can carry out the learning process well.

Characteristics of Differentiated Learning

Menuru(Bayumi, 2021), the characteristics of differentiated learning are different from other learning systems, namely as follows:

- a. Student-centered. The planned learning is based on efforts to understand students as a whole, applying students' style, understanding, initial abilities, and ways of learning as a reference for the learning that will be carried out.
- b. Curriculum-centered. Differentiated learning does not change the concept and objectives of the curriculum, emphasizing creativity in adapting learning plans
- c. Differentiation of learning materials. The material presented is not the same for all students but is tailored to students' interests, prior knowledge, and learning styles.

Differentiated Learning Strategy

There are three strategies that can be implemented to meet students' learning needs and profiles in implementing differentiated learning, namely as follows:

- a. Content Differentiation. Content differentiation is a learning strategy that differentiates the organization and format of content delivery. The content here is the knowledge, concepts, and skills that students need to learn based on the curriculum
- b. Process differentiation. Process differentiation is a learning strategy that differentiates the processes that each student must undergo which allows them to practice and understand the content. Process differentiation focuses on the way students learn, not on the material being studied. Students who study according to their learning style have better learning outcomes than students who study with an inappropriate style.
- c. Product differentiation. Product differentiation refers to learning strategies that differentiate student learning products, such as project assignments, or works of art. Differentiation of products produced by students according to their interests and learning styles.

Principles of Differentiated Learning

According to Bayumi, et al (2021), there are several principles of differentiated learning, including:

1. Continuous assessment in learning. Teachers continually collect information about how students learn, so they can develop learning plans that suit students' needs.
2. Teachers ensure a learning process that recognizes the existence of all students. Students are taught based on shared interests, embracing all students. Teachers view student assignments as valuable and useful.
3. Flexible grouping of students. Teachers design learning that allows all students to work together with a variety of peers at certain times. Students also work with peers who have the same and different levels of readiness as themselves.
4. There is continuous collaboration and coordination between class teachers and field studies teachers.

5. Teachers and students work together to build commitment to realize the expected learning outcomes.
6. Flexible use of time in responding to student learning processes and outcomes.
7. Various learning strategies, such as learning centers, talent and interest development centers and so on.
8. Students are assessed in various ways according to each student's growth and development.

Learning outcomes

According to (Sudjana, 2004), learning outcomes are the abilities that students have after receiving their learning experience. Learning outcomes are the most important part of the learning (Mujiono, 2009) also states that learning outcomes are the result of an interaction between acts of learning and acts of teaching. In the learning process, learning outcomes play a central role as the main indicator of student success and the effectiveness of the learning process. Learning outcomes which include academic and non-academic achievements, not only reflect students' understanding of the lesson material but also show the extent of students' ability to apply the knowledge and skills acquired in everyday life.

Learning Physics

In the physics learning process, the emphasis is not only on mastering concepts but also on mastering four things, namely content or products, processes or methods, attitudes, and technology so that students' understanding of physics becomes complete and can be useful for overcoming the problems they face, for solving student problems. need a correct understanding of concepts in accordance with relevant rules. The right learning to reduce misconceptions is learning that presents cognitive conflicts in students and learning that can provide opportunities for reinforcement of a concept to be carried out repeatedly. (Wenning, 2011).

Teachers accommodate and facilitate the diverse needs of students, in the Merdeka curriculum, it is carried out with the concept of differentiated learning. Differentiated learning is a teacher's attempt to adapt the learning process in the classroom to meet students' individual learning needs (Tomlinson, 1999), a teacher makes consistent efforts to respond to student needs.

Based on this background, this research aims to explore the positive impact and application of differentiated learning strategies in improving student learning outcomes in physics subjects at SMA Negeri 1 Selakau with the hope of encouraging the development of more adaptive, inclusive, and innovative learning at the secondary school level.

Formulation of the problem

Based on the description above, this research will test the hypothesis of whether differentiated learning has a significant effect on improving student learning outcomes in physics subjects at SMA Negeri 1 Selakau. From the results of this research, it is hoped that it will be useful for improving the learning outcomes of students who previously experienced difficulties in understanding physics concepts, by implementing differentiated learning that adapts the learning style and speed level of each student to overcome these problems.

RESEARCH METHODS

This research uses an experimental method with a quantitative approach. The experimental research analysis is used to handle learning analysis data and to identify the relationship between two variables, namely dependent and independent, under controlled

conditions (Riyanto & Hatmawab, 2020). Data obtained from learning analysis will be processed using SPSS with a comparison test of two groups. The research was carried out at Selakau 1 Public High School in Selakau District, Sambas Regency.

This research aims to find out whether differentiated learning in physics learning can improve student learning outcomes. For data needs, researchers carry out assessments or student learning outcomes before and after using differentiated learning strategies implemented in class.

Researchers took samples from differentiated learning analysis carried out in class XF, totaling 35 people in the Physics subject. The research implementation phase carried out a pretest at the beginning of the lesson and then continued with small group divisions, one group consisting of 4 - 7 people. Group division based on student learning profiles (styles) obtained from data provided by the Guidance and Counseling teacher.

Table 1. Diversity of Learning Profiles (Style) for Class X Science 2

Profile (style)Study	Visual Group	Auditor Group	Kinesthetic Group
35 Students	1271	14	9

The analysis in this research was carried out through testing stages on pre-test scores and post-test scores into the SPSS application which aims to identify significant differences between pre-test and post-test results, and to find out whether the data obtained is normally distributed or not.

RESULT AND DISCUSSION

After carrying out experimental research in class XF at SMA Negeri 1 Selakau, researchers will discuss and evaluate the data obtained. Data processing was carried out using quantitative methods by carrying out a normality test first to find out whether the data was normally distributed or not. According to (Haniah, 2013)The normality test can be used to determine whether the data collected is normally distributed, so it can be used in parametric statistics. The results of the pretest and posttest scores are as follows:

Table 2. Pre-Test and Post-Test Average Value Data

Number of Students	Pretest Average Score	Elementary School Pre-test	Post test average score	Elementary School Post Test
N = 35	43.14	0.063	76.71	0.077

The results of the normality test carried out based on pre-test and post-test data are as follows:

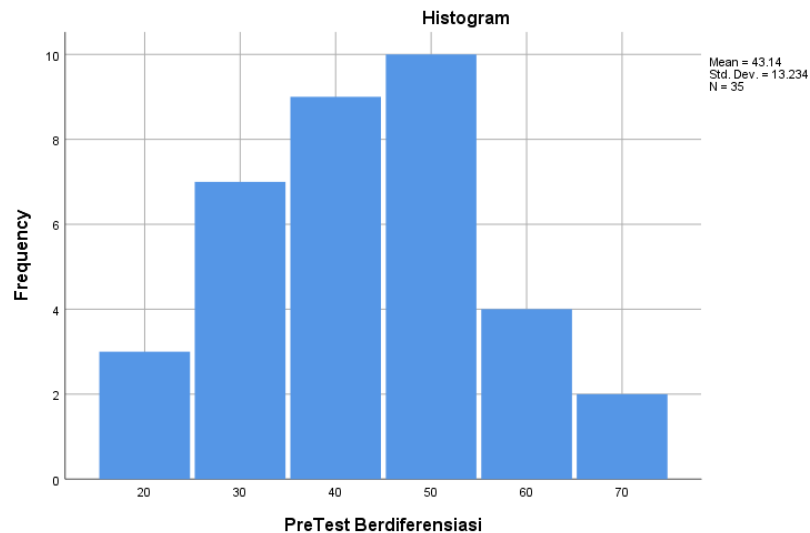
Table 3. Normality Test Results

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PreTest Berdiferensiasi	.155	35	.033	.942	35	.063
PostTest Berdiferensiasi	.132	35	.127	.944	35	.077

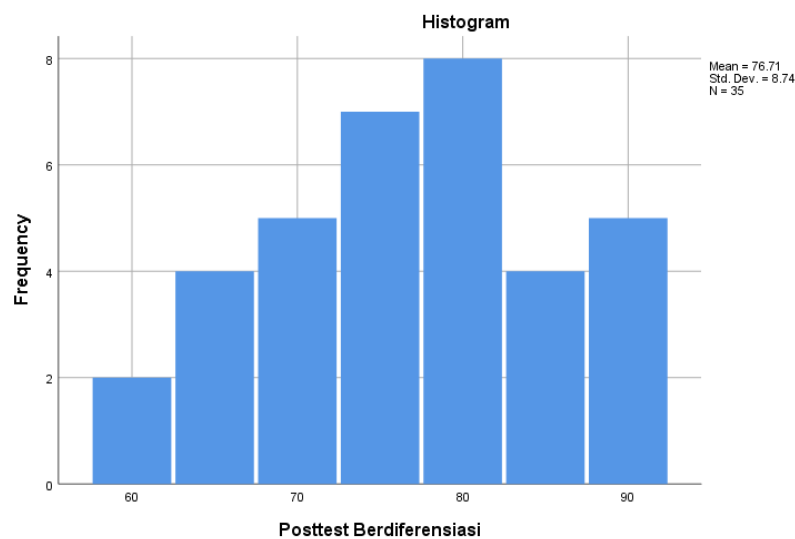
a. Lilliefors Significance Correction

To determine the normality test used, for the number of respondents less than 50 we use the Shapiro-Wilk test in table 3. In this case the df value or sample size used is 35. The results of the Shapiro-Wilk test show a significant value in the pre-test of 0.063 and post test of 0.077. Based on the significance rate $\alpha = 0.05$, if the significance value is greater than $\alpha = 0.05$, then the data is considered normally distributed, and conversely if the significance value is smaller than $\alpha = 0.05$, then the data is considered not normally distributed.

Analysis of the data shows that the significance value in the pre-test is $0.063 > 0.05$ and post test $0.077 > 0.05$, based on the normality test of the data obtained which is normally distributed. Furthermore, the results of the pre-test and post-test scores can be seen in more detail via the SPSS diagram in the image below.



Graph 1. Pre-Test



Graph 2. Post-Test

From the results picture above, it can be seen that the highest score in the pre-test was 70 and the lowest score was 20. The mean value was 43.14 with a standard deviation of 13.234. And for the highest score on the post test there is a score of 90 and the lowest score is 60. The mean score is 76.71 with a standard deviation of 8.740. To find out whether there is a difference or not in the application of differentiated learning in improving student learning outcomes, it is continued with a parametric test because the data we get is normally distributed. So we continue with the Paired-Samples T Test. The calculation results using the SPSS Paired-Samples T Test can be seen in table 4.

Table 4. Paired Samples T Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Differentiated PreTest	43.14	35	13,234	2,237
	Differentiated PostTest	76.71	35	8,740	1,477

From the SPSS output data in table 4 Paired Samples Statistics, it can be seen that the average pre-test score in differentiated learning for class XF is 43.14, while the average post-test score is 76.71. These results indicate that the application of differentiated learning in class XF in the Physics subject at Selakau State High School increased by 33.57. To find out the results of the dependent t-test, look at the SPSS output results in table 5.

Table 5. Paired Samples Test

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PreTest Berdiferensiasi - PostTest Berdiferensiasi	-33.571	9.281	1.569	-36.760	-30.383	-21.400	34	.000

From The Paired Samples Test output table above also provides data about the Mean Paired Differences value which is - 33.571. This value shows that there is a difference between the average value of the pre-test results of 43.14 and the average value of the post-test results of 76.71. And there is a difference between - 36.760 to - 30.383 (95% confidence interval of the difference lower and upper).

Based on the SPSS output results from Table 5 Paired Samples Test, the Sig value is known. (2-tailed) is 0.000 ($p < 0.05$), then H_0 is rejected. Thus it can be concluded that there is an average difference between pre-test and post-test learning outcomes in differentiated learning. This means that there is an influence of implementing differentiated learning in improving student learning outcomes in physics subjects in class XF at SMA Negeri 1 Selakau.

CONCLUSIONS

Based on the data analysis and discussion described above, the aim of this research is to see to what extent the effect of differentiated learning can improve student learning outcomes in physics subjects. at Selakau 1 Public High School. From the results of the Paired Samples T Test analysis, a sig value was obtained. $0.000 < 0.05$. So the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted, this proves that there is a significant difference between the pre-test and post-test results in differentiated learning in class Xf in physics subjects at SMA Negeri 1 Selakau.

The research results show that differentiated learning has an effect on improving student learning outcomes because the implementation of learning is adjusted to students' learning styles, interests, and learning profiles. It is hoped that the results of this research can increase the use of differentiated learning in future learning or in other subjects besides physics subjects. This research has been carried out and carried out in accordance with scientific methods but still has limitations, namely: 1) this research only involved one class, not the entire population at SMA Negeri 1 Selakau; 2) it has not used a variety of other learning media, so that it will increase student learning motivation

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