

## **The Influence of Differentiated Learning and Learning Styles on Student Learning Outcomes in Physical Changes and Chemical Changes at Gonzaga Tomohon Catholic Middle School**

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**Abstract.** This research aims to determine the effect of differentiated learning and learning styles on student learning outcomes in the material of physical changes and chemical changes. This type of research is a quasi-experiment with a 2x3 factorial design. The research population was all seventh grade students at Gonzaga Tomohon Catholic Middle School for the 2023/2024 academic year, totaling 151 people. The research sample was classes 7b and 7c, each consisting of 29 people. Hypothesis testing was carried out with the SPSS 22.0 for Windows program using two way Anova analysis. The results of the research show that (1) there is no significant influence of learning style on student learning outcomes in the material of physical changes and chemical changes (2) there is a significant influence of the application of differentiated learning on student learning outcomes in the material of physical changes and chemical changes (3) there is no There is a significant influence of the interaction between learning styles and differentiated learning on student learning outcomes in physical changes and chemical changes. The average learning outcomes of students taught with differentiated learning are higher than those of students taught with conventional learning. In differentiated learning, the average learning outcomes of students who have an auditory learning style are higher than students who have a visual and kinesthetic learning style. In conventional learning, the average learning outcomes of students who have a visual learning style are higher than students who have an auditory and kinesthetic learning style.

**Key words:** *differentiated learning, learning styles, learning outcomes.*

### **Introduction**

Learning is an individual's experience in an effort to interact with the environment so as to produce changes in the individual. In this case, the interaction in question is educational interaction which allows interaction in the teaching and learning process.

In the world of education, learning is a series of activities carried out by students in order to achieve certain learning outcomes under the direction, guidance and motivation of educators. According to Sudjana (2017), student learning outcomes refer to the achievement of cognitive, affective and psychomotor aspects. And in terms of aspects of change to be achieved, learning outcomes can be described into knowledge or understanding aspects, skills aspects, value aspects and

attitude aspects. Learning outcomes are the final acquisition of the learning process. Learning outcomes are the limitations that students have in understanding the material. So according to Suyono (2018) good learning results can reflect a good learning style because knowing and understanding the best learning style for oneself will help students learn so that the results are maximum. Many factors influence learning outcomes in the classroom, so it is the task of educators to improve student learning outcomes by knowing student learning styles.

In his book *Differentiation of Instruction in the Elementary Grades* (2000), Tomlinson states that differentiated learning is an effort to adapt the learning process in the classroom to meet the individual learning needs of each student. The adjustments in question are related to the student's learning profile, interests and readiness so as to achieve improved learning outcomes. Differentiated learning is a series of commonsense decisions made by teachers that are oriented to student needs. This means that decisions taken in differentiated learning must be rooted in meeting students' learning needs and how teachers respond to these learning needs.

According to Wedyawati & Lisa (2019) science can be defined as a systematic arrangement and scientific discoveries which can take the form of facts, rules, principles, ideas, concepts and others. So, according to Suja (2020) and Wahyuni (2022), the science learning process (one of the materials of which is physical changes and chemical changes) in each educational unit should be held in an interactive, inspiring, fun, challenging way, motivating students to participate actively, and providing space. sufficient for initiative, creativity and independence in accordance with the students' talents, interests and physical and psychological development. In applying differentiated learning to the science learning process, learning style analysis is one way to map student learning needs. Because according to Ningrat et al (2018) learning style is a way of absorbing and understanding information that is used as an indicator for action and is related to the learning environment. Someone may find it easier to learn by taking notes in detail (visual), by listening to explanations (auditory), or by practicing directly (kinesthetic).

From the results of the author's interview with Mrs. Febby Ivone Tumbel S. Pd, principal of Gonzaga Tomohon Catholic Middle School, it is known that Gonzaga Catholic Middle School will only start implementing the independent learning curriculum starting in the new academic year 2023/2024. Previously the school still implemented the K13 curriculum. From the interview results, it was also discovered that the distribution of new students into classes was carried out randomly without prior mapping according to student needs. And from the results of the author's interviews with students in class VII, it is known that they have studied material about physical changes and chemical changes, but they don't really understand it because the material is still taught in a conventional way.

The description above is the background for the author to conduct research focusing on the influence of differentiated learning and learning styles on student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School.

The influence of differentiated learning and learning styles on student learning outcomes in physical changes and chemical changes material can be operationally known through learning outcomes from the experimental class and control class. Therefore, the problem formulation of this research is:

1. Does differentiated learning affect student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School?
2. Does learning style influence student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School?

- Does the interaction between differentiated learning and learning styles influence student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School?

### RESEARCH METHODOLOGY

This research is a quasi-experimental research. The population in this study was all seventh grade students at Gonzaga Tomohon Catholic Middle School for the 2023/2024 academic year, totaling 151 people. Sampling was carried out randomly *simple random sampling* by means of 5 classes taken 2 classes at random. The selected classes were class VIIb, totaling 29 people, as the experimental class and class VIIc, totaling 29 people, as the control class. The independent variables in this research are divided into two, namely manipulative independent variables and attributive independent variables. The manipulative independent variable, namely Learning (A), consists of two parts, namely Differentiated Learning (A1) and Conventional Learning (A2), the attributive independent variable, namely Learning Style (B), which consists of three parts, namely visual (B1), auditory (B2) learning styles. ), and kinesthetic (B3). The factorial design used is 2 x 3 as in table 1.

**Table 1.** Research design

Learning Style (Bj)  Learning methods (Ai)	Visual(B1)	Auditory (B2)	Kinesthetic (B3)
Differentiated Learning Method (A1)	(A1B1)	(A1B2)	(A1B3)
Conventional Learning Methods (A2)	(A2B1)	(A2B2)	(A2B3)

Information:

A1B1: Student learning outcomes with a visual learning style with differentiated learning

A1B2: Learning outcomes of students with an auditory learning style with differentiated learning

A1B3: Student learning outcomes with kinesthetic learning style with differentiated learning

A2B1: Student learning outcomes with a visual learning style with conventional learning

A2B2: Learning outcomes of students with an auditory learning style with conventional learning

A2B3 : Student learning outcomes with kinesthetic learning style with conventional learning

The dependent variable in this research is the learning outcomes of material on physical changes and chemical changes for students in class VIIb and VIIc of Gonzaga Tomohon Catholic Middle School for the 2023/2024 academic year. The research began by giving a learning style

questionnaire to the experimental class and control class, the questionnaire was analyzed using a Likert scale. After that, a pretest was carried out in the experimental class and control class, then differentiated learning treatment for the experimental class and conventional learning for the control class, and finally a posttest in the experimental class and control class. As a prerequisite test, a normality test and a homogeneity test were carried out, then a two way ANOVA analysis of variance was carried out using SPSS 22.0 for Windows on the pretest and posttest data for the experimental class and control class.

There are three pairs of hypotheses tested using two way ANOVA analysis, namely:

H0A: There is no significant influence of learning style on student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School

H1A: There is influence Learning styles have a significant impact on student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School

H0B: There is no significant effect of differentiated learning on student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School.

H1B: There is a significant influence of differentiated learning on student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School.

H0AB: There is no significant effect of the interaction between learning styles and differentiated learning on student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School.

H1AB: There is insignificant influence of the interaction between learning styles and differentiated learning on science learning outcomes student learning outcomes on physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School

## RESEARCH RESULTS AND DISCUSSION

The normality test results were obtained as listed in the Test of Normality table below.

Class		Shapiro-Wilk		
		Statistics	df	Sig.
Learning outcomes	Experimental Class	,930	29	,055
	Control Class	,955	29	,248

**Table 2** Normality test

Based on table 2, it is known that the significance value for the Experimental Class is  $0.055 \geq 0.05$  and the significance value for the Control Class is  $0.248 \geq 0.05$ , so it can be concluded that the learning outcomes data for the experimental class and the control class are normally distributed.

The results of the homogeneity test are as shown in the Test of Homogeneity of Variance output table below.

### Test of Homogeneity of Variance

		Levene Statistics	df1	df2	Sig.
Learning outcomes	<b>Based on Mean</b>	<b>,174</b>	<b>1</b>	<b>56</b>	<b>,678</b>
	Based on Median	,105	1	56	,747
	Based on Median and with adjusted df	,105	1	55,996	,747
	Based on trimmed mean	,166	1	56	,685

**Table 3** Homogeneity test

Based on table 3, it is known that the significance value (Sig) Based on Mean is  $0.678 > 0.05$ , so it can be concluded that the variances of the experimental class and control class are the same or homogeneous.

Hypothesis testing uses a two way anova test, used to determine the truth of the proposed hypothesis. Data on the learning outcomes of students who have Visual, Auditory and Kinesthetic learning styles in the experimental class and control class were analyzed using SPSS 23.0 for Windows with the results as written in the Test of Between-Subjects Effects table below.

### Tests of Between-Subjects Effects

Dependent Variable: Learning outcomes

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	464.153a	5	92,831	1,556	,189
Intercept	258102,642	1	258102,642	4327,559	,000
<b>Learning Style</b>	104,276	2	52,138	,874	<b>,423</b>
<b>Learning</b>	346,966	1	346,966	5,818	<b>,019</b>
<b>Learning Style*Learning</b>	97,220	2	48,610	,815	<b>,448</b>
Error	3101,364	52	59,642		
Total	273392,000	58			
Corrected Total	3565,517	57			

a. *R Squared = .130 (Adjusted R Squared = .047)*

**Table 4.**Two-way Anova test

From the results in table 4 it can be seen that learning style with a significance value of  $0.423 > 0.05$  and  $F_{count} = 0.874 < F_{table} = 3.37$ , then  $H_0A$  is accepted, there is no significant influence of learning style on student learning outcomes in physical changes and chemical changes in junior high school. Gonzaga Tomohon Catholic. Learning (differentiated learning) with a significance value of  $0.019 < 0.05$  and a value of  $F_{count} = 5.818 > F_{table} = 3.37$ , then  $H_0B$  is rejected, there is a significant influence of differentiated learning on student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School. Learning style \* Learning with a significance value of  $0.448 > 0.05$  and a value of  $F_{count} = 0.815 < F_{table} = 3.37$ , then  $H_0AB$  is accepted. There is no significant influence from the interaction between learning style and differentiated learning on student learning outcomes in the material of physics and change. chemistry at Gonzaga Tomohon Catholic Middle School.

### Descriptive Statistics

*Dependent Variable: Learning outcomes*

Learning Style	Learning	Mean	Std. Deviation	N
Visual	Differentiate	69.54	7,965	13
	Conventional	67.80	8,351	10
	Total	68.78	7,994	23
Auditory	Differentiate	74.33	6,861	6
	Conventional	66.00	7,000	9
	Total	69.33	7,916	15
Kinesthetic	Differentiate	69.20	8,904	10
	Conventional	64.20	6,426	10
	Total	66.70	7,981	20
Total	Differentiate	70.41	8,078	29
	Conventional	66.00	7,211	29
	Total	68.21	7,909	58

**Table 5** Average learning outcomes

From table 5 it can be seen that although there are differences in the average learning outcomes of students with Visual, Auditory and Kinesthetic learning styles from the experimental class and the control class, this is not significantly influenced by the interaction between differentiated learning and learning styles. The average learning outcomes of students taught with differentiated learning are higher than those of students taught with conventional learning. This can be seen from the table, the average differentiated learning outcomes are  $70.41 > 66.00$ , the average of conventional learning outcomes. In differentiated learning, students with an auditory learning style (74.33) have a higher average score than students with a visual (69.54) and kinesthetic learning style (69.20). Meanwhile,

in conventional learning, students with a visual learning style (67.80) have a higher average score than students with an auditory (66.00) and kinesthetic learning style (64.20).

## **CONCLUSIONS AND RECOMMENDATIONS**

Based on the problem formulation, hypothesis and research results, it can be concluded that:

1. Differentiated learning has a significant effect on student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School
2. Learning style does not have a significant effect on student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School
3. The interaction between differentiated learning and learning style does not significantly influence student learning outcomes in physical changes and chemical changes at Gonzaga Tomohon Catholic Middle School.

The average learning outcomes of students taught with differentiated learning are higher than those of students taught with conventional learning. In differentiated learning, students with an auditory learning style have a higher average score than students with a visual and kinesthetic learning style. Meanwhile, in conventional learning, students with a visual learning style have a higher average score than students with an auditory and kinesthetic learning style.

Learning style is not the only determinant of improving student learning outcomes, there are many factors that can influence it, because learning style is only one part of a student's profile. However, student learning styles cannot be separated from differentiated learning. Based on the research conducted, researchers concluded that differentiated learning is not something that can be done directly by every teacher. Like students, teachers also need time to adapt and opportunities to learn. Carrying out differentiated learning does not mean that teachers have to teach in 3 different ways according to children's learning styles (Visual, Auditory, Kinesthetic), but rather teachers prepare learning media that includes these three learning styles. In accordance with Sukendra's opinion in (Alhafiz, 2022) that differentiated learning does not mean that teachers have to teach in 32 different ways to teach 32 students. In differentiated learning, teachers must be innovative in choosing learning methods, models and strategies so that students are more motivated in participating in the learning process. My suggestion is that this research can be refined by future researchers. There are still many variables that influence student learning outcomes. Differentiated learning is not something that can be done directly by every teacher, so training needs to be held for teachers. Suggestions for teachers, to remain enthusiastic about conducting research in schools regarding learning styles and differentiated learning so that we can enrich our collective insight in advancing education in Indonesia.

### **The list of used literature:**

1. Alhafiz, N. (2022). Analysis of Student Learning Style Profiles for Differentiated Learning at SMP Negeri 23 Pekanbaru. *Journal of Community Service*, 1(8).
2. Ahriani, F. (2013). The influence of the Cooperative Learning Model and Learning Style on the chemistry learning outcomes of class X students at SMK Negeri 2 Bantaeng. *Chemica Journal*, 1(14), 1-9.
3. Apriliyanti, F., Hanurawan, F., & Sobri, A. Y (2021). Parental Involvement in Implementing the Noble Values of Ki Hadjar Dewantara's Character Education. *Journal of Early Childhood Education*, 1(6), 1-8.

4. Abdurrahmat Fathoni. (2006). *Research Methodology and Thesis Preparation Techniques*. 149.
5. Bire, et al. (2014). "The Influence of Visual, Auditory and Kinesthetic Learning Styles on Student Learning Achievement". *Education Journal: Learning Innovation Research*, (2)44, 168-174.
6. Bobby De Porter and Mike Hemacki. (1992). *Quantum Learning makes learning comfortable and enjoyable*. Bandung: Kaifa
7. Ghufron, M. and Risnawita, R. (2012). *Theoretical Study Learning Style*. Yogyakarta: Student Library.
8. Himmah, FI, & Nugraheni, N. (2023). Analysis of Student Learning Styles for Differentiated Learning. *Journal of Basic Education Research*, 4(1), 31-39.
9. Latifah, N.D. (2023). Analysis of Student Learning Styles for Differentiated Learning in Elementary Schools. *Journal of Education and Learning Research Innovation*, 1(3), 68-75
10. Laila, N. (2021). Analysis of Mathematical Communication Skills in Quadrilateral Material in terms of the learning styles of class VII students at SMP Negeri 2 Bangkalan. Thesis
11. Lestari, I. (2013). The Influence of Study Time and Interest in Learning on Mathematics Learning Outcomes. *Formative: Scientific Journal of Mathematics and Natural Sciences Education*, 3(2), 115-125
12. Marlina. (2019). *Guide to Implementing Differentiated Learning Models in Inclusive Schools*.17-18
13. Mashitoh, D., Dwijayanti, I., Agustini, F. (2023). Analysis of Student Learning Styles to develop differentiated learning tools for class V of SD Negeri Karangejo 01. *Journal of Education and Counseling*, 5(2), 663-669.
14. Miqwati, M., Susilowati, E., Moonik, J. (2023). Implementation of differentiated learning to improve learning outcomes in Natural Sciences in Elementary Schools. *Your Pen:Journal of Elementary School Education*, 1(1), 30-38.
15. Mutakin, T., Hasbullah, Suryana, A. (2019). *Practical Guide to Processing Research Data with the Help of the SPSS Program*. Independent Library: Tangerang
16. Mustakim, US (2020). Effectiveness of Learning in the New Normal Era on Student Learning Outcomes in Discrete Mathematics Subjects. *Uniqbu Journal of Exact Sciences (UJES)*, 1(1), 41-45.
17. Nasution. (2009). *Various Education in the Teaching and Learning Process*. PT. Bumi Aksara:Jakarta, p. 94.
18. Nugraha, SA, Sudiatmi, T., Suswandari, M. (2020). Study of the Effect of Online Learning on Grade IV Mathematics Learning Outcomes. *Journal of Research Innovation*, 1(3), 265-276.



19. Ministry of Education, Culture, Research and Technology, Curriculum Standards Agency, and Educational Assessment Center for Curriculum and Learning. (2021). Principles of Differentiated Learning Development.
20. Oktapiani, H. (2023). The influence of the OIDDE learning model on learning outcomes, ethical attitudes, and students' critical thinking abilities in Biology subjects. Directorate of Postgraduate Programs: Muhamadiyah University Malang. Thesis
21. Pitaloka, H., & Arsanti, M. (2022). Differentiated learning in the independent curriculum. Semarang: Proceedings of the 4th Sultan Agung National Seminar, 34-37
22. Poerwadarminta, WJS (2006). Indonesia Dictionary. Jakarta: Balai Pustaka
23. Rahmawati T., & Daryanto. (2015). Learning Theory and Educative Learning Process. Yogyakarta: Gava Media.
24. Suja, IW (2020). Science Process Skills and Measuring Instruments (Nuraini (ed.); 1st ed.). PT Raja Grafindo Persada
25. Sugiyono. (2006). Sugiyono, Educational Research Methods Quantitative, Qualitative and R&D Approaches, Alfabeta: Bandung, 2006, p. 3. Educational Research Methods Quantitative, Qualitative and R&D Approaches, 22–29.
26. Trowbridge, L. W., & Bybee, R. W. (1990). Becoming a secondary school science teacher. Merrill Publishing Company.
27. Tomlinson, C. A. (2000). Differentiation of Instruction in the Elementary Grades. ERIC Digests, 1-7
28. Uno, HB (2008). New Orientations in Learner Psychology. Jakarta: Bumi Literacy
29. Ulfa, M. (2018). Application of the Thinking Aloud Pairs Problem Solving (TAPPS) Cooperative Learning Model with a Scientific Approach in View of Student Learning Styles. Proceedings: National Seminar on Mathematics and Mathematics Education at UIN Raden Intan Lampung.
30. Suyono, A. (2018). The Influence of Learning Style on Learning Outcomes in the Accounting Subject class XI IPS SMA N 3 Tapung 2017/2018 Academic Year. PeKA: Journal of Accounting Economics Education FKIP UIR 6(1), 1-10
31. Wahyuni, AS(2022). Literature Review: Differentiated Approach in Science Learning. Journal of Mathematics and Natural Sciences Education, 2(12), 118-125
32. Wedyawati, N., & Lisa, Y. (2019). Science Learning in Elementary Schools. Yogyakarta: Deepublish Publisher
33. Wulandari, AR, Masturi, M., Fakhriyah, FI (2021). The Influence of YouTube-Based Learning Media on Students' Science Learning Outcomes in Elementary Schools. Educative: Journal of Educational Sciences, 3(6), 3779-3785