Abdurrauf Science and Society
Vol. 1, No. 4, 2025, pp. 545~557
ISSN: 3090-093X; DOI: 10.70742/asoc.v1i4.304

The Effect of Differentiated Learning And Ice Breaking on The Outcomes Of Science Learning of Grade Iv Elementary School Students in Tomohon Selatan District

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ARTICLE INFO

Article history:

Received 21-05-2025
Accepted 17-06-2025
Published 18-06-2025

Keywords:

differentiated learning;
ice breaking;
learning outcomes;
science;
elementary school.

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Competing interest:
The author(s) have declared that no competing interests exist

ABSTRACT

This study aims to describe the effect of differentiated learning and breaking on the learning outcomes of science and natural sciences in grade IV elementary school students in South Tomohon District. The background of this study is based on the fact that students have diverse learning characteristics, while the learning approaches used in class still tend to be uniform. On the other hand, science and natural sciences learning requires active involvement and psychological readiness of students, which are often not optimally developed. This study uses a quantitative method with a quasi-experimental design in the form of a pretest-posttest control group design. The subjects of the study were grade IV elementary school students who were selected purposively. The instruments used were learning outcome tests referring to indicators of science learning achievement and observation sheets for learning implementation. The results of the data analysis showed that there was a significant difference in the results of learning science between students who participated in differentiated learning accompanied by ice breaking and students who participated in conventional learning. The application of differentiated learning helps students learn according to their needs and learning styles, while ice breaking has been proven to improve the pleasant classroom atmosphere and students' mental readiness to learn. These two strategies synergistically provide a positive contribution to improving student learning outcomes. Thus, it can be concluded that the implementation of differentiated learning combined with ice breaking has a significant effect on the learning outcomes of elementary school students. This finding recommends that teachers adopt a learning approach that is responsive to the individual needs of students and pays attention to psychological aspects in the learning process.

Citation: Wilar, F. I., Rorimpandey, W. H. ., & Pangkey, R. D. . (2025). The Effect of Differentiated Learning And Ice Breaking on The Outcomes Of Science Learning of Grade Iv Elementary School Students in

Tomohon Selatan District. *Abdurrauf Science and Society*, *1*(4), 545–557. https://doi.org/10.70742/asoc.v1i4.304

INTRODUCTION

Basic education plays an important role in forming the foundation of students' knowledge, skills, and character. In the learning process, teachers have the responsibility to create a conducive, interesting, and relevant learning atmosphere so that students can achieve optimal learning outcomes. One of the challenges in the world of education today is how to present learning that can meet the diverse needs of students, especially in the context of the Independent Curriculum which emphasizes differentiated learning.

Learning in the 21st century demands an approach that can accommodate the diversity of student characteristics in the classroom. Students have differences in learning styles, interests, readiness, and cognitive backgrounds that need to be considered in the learning process. Unfortunately, learning practices in many elementary schools are still uniform and teacher-centered. This causes some students to have difficulty understanding the material, especially in subjects that integrate various disciplines such as Natural and Social Sciences (IPAS).

Science as an integrative subject that requires conceptual understanding as well as mastery of process skills, requires teachers to be able to apply adaptive learning strategies. Therefore, the application of differentiated learning is a very relevant approach. Differentiated learning provides space for teachers to adjust content, processes, and learning products according to the needs of individual students (Tomlinson, 2017; Andriyani & Supahar, 2020).

Differentiated learning strategies are based on the belief that every child has different potential and can develop optimally if facilitated in the right way. Research by Pratiwi and Wahyuni (2021) shows that differentiated learning has a positive effect on student motivation and learning outcomes at the elementary level. Teachers who implement differentiation can create more inclusive learning, stimulate critical thinking, and strengthen conceptual understanding.

However, differentiation strategies alone are not enough if students are not in a psychological condition ready to learn. In this case, the ice breaking technique acts as an important psychological bridge. Ice breaking, as part of the initial learning activities, helps to lighten the mood, increase concentration, and build student involvement in the learning process. According to Sari & Haryanto (2022), ice breaking activities can increase focus, improve the classroom atmosphere, and reduce student learning anxiety.

Combining differentiated learning and ice breaking has the potential to be an effective strategy in improving science learning outcomes. Ice breaking can prepare a conducive mental condition before students take part in learning that is designed in a differentiated manner. This combination can create a positive, enjoyable, and meaningful learning climate for elementary school students who are in the concrete-operational phase of their cognitive development (Piaget in Santrock, 2018).

Several empirical studies also support the effectiveness of this approach. Research by Lubis et al. (2021) shows that the use of differentiation strategies accompanied by fun activities such as ice breaking can significantly improve learning outcomes. Likewise, research by Rahayu and Kurniawan (2020) found that students who were actively involved from the beginning of learning tended to have better

understanding and showed significant improvements in learning outcomes compared to groups that followed conventional learning.

In Tomohon Selatan District, teachers face challenges to improve the learning outcomes of fourth grade students who show varying levels of success. Data from initial observations indicate significant differences in learning outcomes among students with diverse backgrounds, abilities, and motivations. Therefore, this study aims to examine the effect of the implementation of differentiated learning and Ice Breaking on the learning outcomes of fourth grade elementary school students in Tomohon Selatan District. From seventeen schools in Tomohon Selatan District, I took two schools as samples, namely SD Inpres 482 Walian and SD Katolik V. The following is data from the three sample schools:

Table 1.1 List of research samples

No.	School name	Total number of students	Number of students in grade IV	Information
1.	Primary School 482 Walian	109 people	27 people	Driving school
2.	Catholic Elementary School V Tomohon	190 people	27 people	

Learning must be centered on students (student center). A good class is not a class where the teacher is the most dominant active, but rather one where the students are active. The teacher is not the only source of learning, but becomes one of the sources of learning.

Based on the explanation above, the researcher is interested in conducting a test study on the Effect of Differentiated Learning and Ice Breaking on the Science Learning Outcomes of Grade IV Elementary School Students in South Tomohon District.

METHOD

This study aims to describeinfluence onDifferentiated learning and Ice breaking on the science learning outcomes of Grade IV Elementary School Students in South Tomohon District.This study uses a quantitative approach with a quasi-experimental design). The quasi-experimental design used is nonequivalent control group design. This study has two groups of students, namely one group that is given treatment with differentiated learning and Ice breaking as a threatment group and one group that is not given treatment with differentiated learning and Ice breaking as a control group. The following is the research design.

Group	*Pretest*	Treatment	*Posttest*
Threat	O1	X	O2
Control	O1	-	O2

Information:

O1 :Pre-test threatment group and control group
O2 :Post-test of threatment group and control group
X :Treatment using differentiated learning and ice breaking
- :conventional learning treatment

This research was conducted in 2 elementary schools in South Tomohon

District, namely SD Inpres 4/82 Walian as the driving school and SD Katolik V Tomohon. The time of the research was conducted in the second semester of the 2024/2025 academic year. The population in this study were all fourth-grade students of elementary schools in South Tomohon District in the 2024/2025 academic year. The sampling technique in this study used Nonprobability sampling. The sample in this study were fourth-grade students of SD Inpres 4/82 Walian and SD Katolik V Tomohon.There are two types of data collection techniques in this study, namely testing and observation techniques. Pretest and Posttest: Conducted to threatment and control. Tests are given to students before learning (pretest) and at the end of learning (posttest). This test is conducted to measure students' understanding of the material being studied. Observation: Observing student activities during learning to ensure the implementation of differentiated learning and Ice breaking. The instruments used in the study were learning outcome tests and observation sheets. Before being used in the study, the instrument was first tested for validity and reliability. The data analysis technique in this study went through three stages, namely the data description stage, the prerequisite test stage and the hypothesis testing stage. The steps taken at the data description stage were to make a summary of the distribution of pretest and posttest data from the descriptive statistical results of the threatment and control groups. The prerequisite test in this study used the homogeneity test and the normality test. This hypothesis test used the independent sample t test. The independent sample t test aims to see the effect of differentiated learning and Ice breaking on the science learning outcomes of grade IV Elementary School students.

RESULT AND DISCUSSION

This study aims to describe the effect of differentiated learning and ice breaking on the learning outcomes of grade IV elementary school students in South Tomohon District. The instrument for the learning outcome test of grade IV students was first tested for validity and reliability before being used in the study to ensure the validity and accuracy of an instrument. The validity test used in this study was the product moment test. The following are the results of the validity test on the instrument for learning outcomes of grade IV students.

Table1. Results of the Validity Test of the Science Learning Outcome Instrument

No Item	Rtable	rhitung	Information	No Item	Rtable	rhitung	Information
Item 1	0.396	0.317	Invalid	Item 16	0.396	0.506	Valid
Item 2		0.369	Invalid	Item 17		0.526	Valid
Item 3		0.263	Invalid	Item 18		0.431	Valid
Item 4		0.763	Valid	Item 19		0.338	Invalid
Item 5		0.384	Invalid	Item 20		0.497	Valid
Item 6		0.638	Valid	Item 21		0.319	Invalid
Item 7		0.505	Valid	Item 22		0.724	Valid
Item 8		0.438	Valid	Item 23		0.505	Valid
Item 9		0.524	Valid	Item 24		0.270	Invalid

No Item	Rtable	rhitung	Information	No Item	Rtable	rhitung	Information
Item 10		0.487	Valid	Item 25		0.460	Valid
Item 11		0.506	Valid	Item 26		0.487	Valid
Item 12		0.182	Invalid	Item 27		0.506	Valid
Item 13		0.534	Valid	Item 28		0.293	Invalid
Item 14		0.627	Valid	Item 29		0.534	Valid
Item 15		0.317	Invalid	Item 30		0.627	Valid

Based on the Pearson product moment test presented in the table, it was obtained that out of 30 learning outcome test questions, 10 were invalid and 20 questions were valid or suitable for use to measure the science learning outcomes of grade IV elementary school students.

The next step taken after the validity test of the instrument is the reliability test on the IPAS learning outcome instrument, in order to determine whether the instrument to be used is permanent or not. The following presents the results of the reliability test of the IPAS learning outcome instrument.

Table2. Results of the Reliability Test of the Science Learning Outcome Instrument

Reliability Statistics	
Cronbach's Alpha	*N of Item*
0.887	30

Based on the reliability test using the Cronbach's Alpha test, the Cronbach's Alpha value obtained was 0.887 > 0.60 so thatIt can be concluded that the science learning outcome instrument is reliable with a very high category.

After the research instrument is declared valid and reliable, the next step is that the instrument can be used to assess the science learning outcomes of grade IV students in South Tomohon sub-district.In this study, there are several data used in data processing, including pretest data from the experimental and control classes and posttest data from the experimental and control classes. The experimental class in this study was SD SD INPRES 4/82 Walian with the treatment of differentiated learning and Ice breaking. And the control class in this study was SD Katolik V Tomohon without treatment or conventional learning.

1. Description of learning outcome data

Learning outcome data in the experimental class, namely differentiated learning and ice breaking, and the control class, namely using conventional learning, are presented in the table.

Table3. Results Description of Learning Outcome data

Class		N	Empirical Value			
			Min	Max	Mean	Std
Experimental Class (Differentiated Learning and Ice Breaking)	*Pretest*	27	13	73	42.67	16,791
	Posttest	27	67	100	88.89	9.183
Control Class (Conventional Learning)	*Pretest*	27	13	53	31.81	12,310
	Posttest	27	47	93	69.89	12,873

Based on the results presented in the table, it can be described that the pretest results in the experimental class or class using differentiated learning and ice braking

and the control class, namely learning using conventional methods that have the same number of students, namely 27 people, have a minimum value or the lowest value with the same score, namely 13, while the maximum value or the highest value of the two classes is different, namely 73 and 53, with a mean or average value of the two classes, namely 42.67 and 31.81. This shows a low range of values from these two classes, because the pre-test value is the learning value produced before there is treatment or treatment from the experimental class or control class, so it makes sense that the values obtained from the range of the two classes are included in the low category.

The next result that can be described from the research results table is the post-test result from the experimental class or class using differentiated learning and Ice breaking and the control class or class using conventional learning. The post-test value means the value obtained after being treated or after there is a different treatment from both classes, both the experimental class and the control class. Based on the existing table, it can be described that both classes have the same number of students, namely 27 students with a minimum or lowest value of 67 and 47, a maximum or highest value of 100 and 93, and a mean or average value from the two classes with different treatments, namely 88.89 and 69.89. a clear comparison of the experimental class and the control class. And if the conclusion is drawn from the existing results, the results of learning science of grade IV students from the experimental class or differentiated learning and Ice breaking are superior to the results of learning science of grade IV students from the control class or class with conventional learning. Thus, it can be concluded that classes using differentiated learning and ice breaking have experienced an increase in science learning outcomes and have met the KKTP standards in science learning in class IV.

2. Hypothesis Test Results

The data analysis used in this study is divided into two parts, namely data analysis for prerequisite testing and data analysis for research hypothesis testing. The following is a detailed explanation of the two analyses.

3. Data analysis prerequisite test results

As a requirement to be able to conduct data analysis, researchers must conduct prerequisite tests or prerequisite data analysis with normality and homogeneity calculations. The following presents the results of the normality and homogeneity prerequisite tests to meet the requirements to continue with the hypothesis test.

a. Normality test results

The calculation of the normality of each research variable is intended to determine the data of each research variable comes from a normally distributed population. The calculation of normality is carried out to measure the pretest and posttest of students' science learning outcomes in the experimental class that received differentiated learning and Ice breaking treatments and in the control class that did not receive treatment or learning using conventional learning models.

The test criteria used to measure the normality of the population in this study are if Asymp. Sig > from the alpha value set $\alpha = 0.05$, and the data is not normal if Asymp. Sig < from the alpha level set $\alpha = 0.05$. The normality test is calculated using Kolmogorov-Simirmov with the help of the IBM SPSS ver 27 program. The probability

significance value (p-value) > from, and the population is not normally distributed if the p-value < from the significance α = 0.05. The results of the normality calculation using the help of IBM SPSS ver 27 can be seen in the following table:

Table4. Normality Test Results

Class	Variables	Kolmogorov-Smirnov		Conclusion
		Z	*Sig.*	
Experimental Class (Differentiated learning and Ice breaking)	*Pretest* learning outcomes	0.138	0.199	Normal
	Posttest learning outcomes	0.154	0.098	Normal
Control Class (conventional learning)	*Pretest* learning outcomes	0.134	0.200	Normal
	Posttest learning outcomes	0.152	0.111	Normal

Based on the research results presented in the table of the results of the normality test of the pretest and posttest values of the experimental class and the control class showed a sig value of more than 0.05, so that based on the decision making of the normality test H0 was accepted. Thus, based on the data on the results of students' science learning consisting of the experimental class or class using differentiated learning and Ice breaking and the control class or class using conventional learning, the sample is normally distributed so that it can continue to the next test.

b. Homogeneity Test Results

Homogeneity test in this data analysis was conducted using IBM SPSS Ver 27. The data tested for homogeneity were the data on the results of learning science in grade IV elementary school students. The results of the homogeneity test of the results of learning science are presented in the following table.

Table5. Homogeneity Test Results

Data Homogeneity Test for Science Learning Outcomes				
N0	Data Types	Sig. Value	Condition	Information
1	Class (Differentiated learning and Ice breaking)	0.071	>0.05	Homogeneous
2	Control Class (Conventional learning)	0.102	>0.05	Homogeneous

Based on the homogeneity test data presented in the table, the significance value of the pretest data on the results of learning science is0.071, then in the posttest data the results of students' science learning were0.102, these results indicate that the significance of the pretest and posttest data on the results of learning science is homogeneous. Thus, researchers can proceed to the next test stage.

c. Hypothesis Test Results

This hypothesis test uses an independent sample test. The independent sample t-test aims to see the effect of differentiated learning and Ice breaking on the science learning outcomes of grade IV Elementary School students.

The basis for decision making in this research is:

Ha: There isinfluencewhich is significant in the application of differentiated learning and Ice Breaking on the science learning outcomes of grade IV Elementary School students.

H0: Noneinfluencewhich is significant in the application of differentiated learning and Ice Breaking on the science learning outcomes of grade IV Elementary

Table6. Hypothesis Test Results School students.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
asil_Belajar_IPAS	Equal variances assumed	2.770	.102	6.243	52	<.001	19.000	3.043	12.893	25.107
	Equal variances not assumed			6.243	47.019	<.001	19.000	3.043	12.878	25.122

Group Statistics

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Hasil_Belajar_IPAS	Eksperimen	27	88.89	9.183	1.767
	Kontrol	27	69.89	12.873	2.477

Decision making and drawing conclusions on hypothesis testing are carried out at a significance level of 0.05. The criteria used in drawing conclusions are if the sig value <0.05; then Ha is accepted or there is a difference in influence, if the sig value>0.05; then Ha is rejected or there is no influence. The following are the results of the independent sample t test. Based on the results presented in the table, it can be described that the results of the significance of the results of learning science from the experimental class or class using differentiated learning and Ice breaking and the control class or class with conventional learning are 0.001 <0.05 so that based on the decision making it can be concluded that Ha is accepted and Ho is rejected or there is an influence of learning science learning outcomes on learning using differentiated learning and Ice breaking.

Based on the existing table, it can also be seen that there is a difference in the average results of learning science of grade IV students in the experimental class or class using differentiated learning and Ice breaking and the control class or class using conventional learning, which are 88.89 and 69.89. so this hypothesis can be concluded that there is an influence of learning science results on the application of differentiated learning and Ice breaking in learning and there is a difference in the average value of learning science results in grade IV Elementary School students who use differentiated learning and Ice breaking and classes with conventional learning, in this case the experimental class is superior.

DISCUSSION

This study aims to determine the differences in the influence of differentiated learning and ice breaking on the science learning outcomes of grade IV students in South Tomohon District.

Based on the results of the independent sample t test, the results of learning science in differentiated learning and Ice breaking obtained a significance value of 0.001 or less than 0.05 (<0.05) so that based on the decision making Ha is accepted and H0 is rejected, thus it can be concluded that differentiated learning and Ice breaking have an effect on learning science and there is a difference in the increase in learning science in the experimental class or learning using differentiated learning and Ice breaking and the control class or class with conventional learning, this is evidenced by the results of the average value in differentiated learning and Ice breaking pretest which is 42.67 and Posttest which is 88.89 while in conventional learning the pretest is 31.81 and Posttest is 69.89. this shows that both differentiated learning and Ice breaking and conventional learning both experience an increase in learning but the superior one is differentiated learning and Ice breaking.

This research is in line with research conducted by(Istiqomah et al., 2024)This study revealed that the application of differentiated learning strategies has a significant positive effect on the learning outcomes of fifth grade students in the subject of Natural and Social Sciences (IPAS) at SDN. Based on data analysis, it can be seen that the group of students who applied this strategy showed a greater increase in learning outcomes compared to the group using conventional methods. This increase in learning outcomes can be attributed to several factors, including: Learning Adaptation: Differentiated learning strategies allow teachers to adjust materials and methods according to students' needs, learning styles, and interests and Engagement and Motivation: Students feel more engaged and motivated when they learn in ways that are relevant to them, which in turn supports deeper understanding. using conventional methods. This increase in learning outcomes can be attributed to several factors, including: Learning Adaptation: Differentiated learning strategies allow teachers to adjust materials and methods according to students' needs, learning styles, and interests and Engagement and Motivation: Students feel more engaged and motivated when they learn in ways that are relevant to them, which in turn supports deeper understanding.

Other research that supports the results of this research is research conducted by(Paradita et al., 2021)Ice Breaking technique has a significant influence on the learning outcomes of fourth grade students, the increase in students' concentration after being given the Ice Breaking technique is also very visible and learning becomes more varied because of Ice Breaking so that it is not monotonous. The calculation of the hypothesis test states that it is accepted, which means that the Ice Breaking technique has an influence on the science learning outcomes of fourth grade students. Thus, the Ice Breaking technique has a fairly good influence on student learning outcomes. In addition, in learning using this Ice Breaking technique, it provides its own motivation in learning activities. This can be seen clearly through the responses obtained through learning with this technique. students are more enthusiastic in following lessons by doing several scientific experiments. Students are very interested in doing experiments that are carried out in groups, in addition, students also pay close attention to the direction given by the teacher. Cooperation and participation between other students can be seen clearly through the experiments carried out so that they can exchange ideas well with other students.

CONCLUSION

Based on the analysis of research data and discussion, it can be concluded that there is an influence on differentiated learning and Ice breaking on the learning outcomes of fourth grade students' science, this is evidenced by a significance value of 0.001 or more than> 0.05. In this study, there is also a difference in influence between the experimental class or class with differentiated learning and Ice breaking and the control class or class with conventional learning, this is evidenced by the average results of the pretest and posttest and the experimental class or class using differentiated learning and Ice breaking. The pretest value is 42.67 and the posttest is 88.89. While in the control class or class with conventional learning, the pretest value is 31.81 and the posttest value is 69.89. Thus, it can be concluded that differentiated learning and Ice breaking are superior to conventional learning.

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