

The Effect of Project-Based Learning Model Based on Differentiated Learning on Learning Outcomes of Grade IV Students of Inpres 5 Elementary School in West Halmahera

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ABSTRACT

The objective of the present study was to ascertain the impact of the project-based learning (PjBL) model, grounded in the principle of differentiated learning, on the enhancement of student learning outcomes in grade IV SD. The study employed a quantitative approach and utilised the Quasi Experiment method. The population of this study comprised fourth grade students of SD Inpres 5 West Halmahera, who were treated as an experimental class with the Project Based Learning (PjBL) model, and fourth grade students of SD Inpres 4 West Halmahera, who were given the direct learning model and served as a control class. The collection of data was conducted using multiple-choice question instruments. The collected data were then subjected to analysis using Ancova and the SPSS 30 for Windows program. The results obtained indicated a significant value of 0.001, which is less than 0.05. Consequently, the null hypothesis (H0) was rejected and the alternative hypothesis (H1) was accepted. The findings of this study demonstrate the efficacy of the Project Based Learning model, particularly in its application to differentiated learning, in enhancing the learning outcomes of fourth grade students.

INTRODUCTION

Project Based Learning (PjBL) is one of the learning models whose application is carried out through project activities which are the focus of learning (Elisabet, et al., 2019). According to Afriana, (2016) states that PjBL learning is proven to improve students' skills and creativity. Furthermore, Ergül & Elif (2013) stated that this model is more effective for students if learning is associated with everyday life related to knowledge and technology. Differentiated learning is an effort to accommodate students based on their characteristics. When in the environment At school, students come with their own characteristics. These differences in characteristics can be in the form of abilities, experiences, talents, interests, languages, cultures, learning styles which are also called student diversity (Santika & Khoiriyah, 2023). Student diversity is a reality seen in schools. Therefore, teachers are required to deliver subject matter using appropriate strategy methods and assess students objectively. Especially teachers are obliged to pay attention to student diversity and provide services that suit the individual needs of students (Meilia & Murdiana, 2019).

Differentiated learning is a learning approach that needs to be used by teachers to meet the learning needs of individual students. Teachers must adjust subject matter, teaching methods and learning approaches according to the abilities, interests and needs of each student. This aims to prevent students from being frustrated or failing in undergoing the learning process (Agung, 2020). It is interesting to note that Purba (2021) suggests that differentiated learning is not the same as individualised learning, which is often used to teach children with special needs. In the latter, teachers are not expected to provide one-on-one instruction to each student, with the aim of understanding the specific needs of each individual, but students can be in large, small or independent groups in learning. Differentiated learning also provides support for lower level students with identified or unidentified learning disabilities, allowing students to become peer tutors. So as to strengthen the understanding of students who have mastered the material while providing support for students who are still struggling. The development of science and technology today is very rapid and has an impact on the realm of education. According to Septikasari and Frasandy (2018) who stated that 4C skills (critical thinking, creativity, collaboration, communication) are needed by the nation's children and the involvement of all parties, especially schools, is needed in preparing 21st century skills. This is in line with education in the 21st century which emphasizes the student-centered learning process so that teaching and learning activities become more innovative and creative (Maarif & Rustaman, 2019).

It appears that, based on the findings of the identification process, the current educational implementation may not have undergone significant change, as it continues to utilise a learning system that assumes uniformity among children, potentially overlooking their diverse abilities. According to Iskandar (2021), in his research on differentiated learning, it appears that teachers may feel they are teaching one student in one class, while in another class, there may be approximately 15-30 students who have uniqueness, ability

and diverse learning experiences. Consequently, it is not uncommon for students to feel bored, which may impact their learning motivation and consequently lead to very low learning outcomes. Therefore, teachers need to realize that each child is unique and has different characteristics from one child to another. This means that homogenizing things that are not. The need to homogenize into a culture in the learning process without distinguishing interests, talents, learning readiness, learning profiles and the living conditions of children and communities from one another must be a concern and need to be accommodated (Jenyana, 2022).

The impact of education that does not accommodate student learning needs is often seen in the low learning outcomes of each student. In addition, students could perhaps be more actively involved in every learning process. It seems to be in alignment with the observations made of students in elementary schools, particularly in class IV, who also appear to be less involved in each learning process, which could have an impact on the learning results. This condition is also reflected in grade IV students at SD Inpres 5 West Halmahera Regency. Based on initial observations, students in this school show difficulty in understanding concepts and their application in everyday life which has the potential to hinder the development of students holistically so that it has implications for unsatisfactory learning outcomes, especially in science subjects. This is due to the limited learning resources available, such as the lack of teachers' ability to use relevant methods to create innovative learning and according to students' learning needs and the low awareness of teachers in accommodating students' different learning needs.

These low student learning outcomes can be improved through models, media and approaches to learning that teachers will use. As one of the spearheads of education, teachers are obliged to create an effective learning system for students. Therefore, teachers need to continue to develop and master the latest knowledge and technology. Various kinds of strategies that inspire and are needed in carrying out independent learning, one of the approaches that has been considered is the application of the Project Based Learning (PjBL), which is believed to have the potential to contribute to improvements in science literacy and learning outcomes for fourth grade students of SD Inpres 5 West Halmahera. The aim of this study is to determine the effect of the PjBL on improving literacy and student learning in grade IV elementary school.

THEORETICAL REVIEW

The project-based learning model is a learning model that encourages students to be directly involved in learning and be able to produce real work or products based on the knowledge and experience they receive in order to provide experience and improve skills in managing various sources. According to Setiawan, et al (2019) stated that Project based learning (PjBL) helps students to develop science skills in a relevant and meaningful context. According to Lee, et al (2019) stated that the benefits of PjBL in improving science literacy are project-based learning students learn about science concepts through projects or tasks that are meaningful and relevant to the real world. Students not only

memorize the material, but also learn how to use it. apply it in everyday life. Project Based Learning also provides benefits to improving science literacy, namely PjBL encourages students to conduct independent research. According to Murti (2018) defines science literacy as a multidimensional skill that includes knowledge (vocabulary, concepts, and facts), disposition (behavior & attitude), process skills (skilled & intellectual), and its relationship with facts in the environment.

It has been suggested that learning outcomes are the abilities of students obtained after learning activities (Nugraha, 2020). These outcomes refer to the specific competencies or abilities that students acquire through their engagement in the teaching and learning process, encompassing cognitive, affective, and psychomotor skills (Wulandari, 2021). In the words of Mustakim (2020), learning outcomes are defined as the achievements of students in specific assessments that have been outlined by the curriculum of their previous educational institution.

To test the idea put forward in this study, we looked at two things. First, we studied the 'Project Based Learning' model, which is based on different learning styles. Second, we studied the 'science literacy' and 'learning outcomes' of the people taking part, were tested using analysis through the Analysis Covariance (Ancova) test. with the basis for decision making is if $\text{Sig.} \leq 0.05$ then H_0 is rejected and H_1 is accepted, but if the significance value ≥ 0.05 then H_0 is accepted and H_1 is rejected. Where H_1 is that there is an effect of PjBL learning model based on differentiated learning on science literacy and student learning outcomes. While H_0 is that there is no effect of PjBL learning model based on differentiated learning on science literacy and student learning outcomes.

METHODOLOGY

The approach taken in this research is what is known as the quasi experiment method. This method has a control group, but it is not possible for it to function fully to control external variables that can affect the implementation of the study. The research design that was implemented was Non-Equivalent Control Group Design. In this design, there are two groups (the control group and the experimental group) that are not selected randomly. The research design is outlined in Table 1 below:

Table 1. Research Design			
Group	Initial Test	Treatment	Final Test
Experiment	O 1	X 1	O 2
Control	O 1	X 2	O 2

Description:

O1: a test given before the teaching and learning process begins, given to both groups (experimental and control).

X1: the provision of teaching and learning process using PjBL-differentiated learning model.

X2: teaching and learning process using direct learning model.

O2: test given after the learning process takes place, given to both groups (experimental and control).

The study population comprised fourth grade students from both SD Inpres 4 and SD Inpres 5 West Halmahera, totalling 30 individuals. It is hoped that the sample is representative of the population in terms of number and characteristics. This research procedure is divided into three stages, namely the preparation, implementation, and final stages of research. Researchers took 2 classes as samples, namely class IV SD Inpres 5 West Halmahera totaling 16 students as an experimental class treated with a project-based learning model based on differentiated learning and class IV SD Inpres 4 West Halmahera totaling 14 students as a control class that will be treated using the Direct learning model. It is possible to collect data using tests and questionnaires. Data analysis techniques using normality test, homogeneity test and hypothesis testing using covariate analysis.

RESULTS

The tests that are done before this study are called the "normality test" and the "homogeneity test." The normality test checks if the data follows a normal distribution, while the homogeneity test looks at whether the data sample comes from a population with the same variance. In this study, we also did data analysis using something called the Covariance Analysis (Ancova) test. This test was used to see if the Pjbl model based on differentiated learning had an effect on the learning outcomes of 4th grade students.

Normality Test of Learning Outcomes

The data entry process for testing the normality of the learning outcomes data employs the SPSS 30 for Windows programme, utilising the Saphiro-Wilk statistical test. The basis for decision-making in the normality test is whether the residuals are normally distributed, i.e. whether they have a significance level above 5%. The results of the aforementioned normality test are presented in the following section.

Table 2. Normality Test of Learning Outcomes

	Class	Statistics	Df	Sig.
Learning Outcomes	Pre Control	.959	14	.706
	Post Control	.961	14	.734
	PreExsperimen	.903	16	.090
	PostExsperimen	.971	16	.852

As demonstrated in the table, the results of the normality test calculation have a probability of significance level greater than 0.05. The significance value in this study indicates that the statistical value of the normality test is greater than or equal to 0.05, thereby suggesting that the data distribution of the two classes is normally distributed.

Homogeneity Test of Learning Outcomes

Homogeneity testing using Levene's test with data input through IBM SPSS 30 for Windows. The results of the homogeneity test on learning outcomes data can be seen in the following table.

Table 3. Homogeneity Test of Learning Outcome Table

Learning outcomes	Levene statistic	df1	df2	Sig.
Based on Mean	.302	1	28	.587
Based on Median	.254	1	28	.618
Based on Median and with adjusted df	.254	1	26.745	.618
Based on trimmed mean	.304	1	28	.586

Based on the table of homogeneity test results, it can be seen that the significance value for the learning outcomes data obtained is 0.587 which is greater than 5% ($0.587 \geq 0.05$) so that it can be concluded that the data variants in this study are homogeneous.

Hypothesis Test of Learning Outcomes

The hypothesis testing in this study was conducted using Covariance Analysis (Ancova). The data entry process utilised the SPSS 30 for Windows program. Decision-making in the context of hypothesis testing is contingent upon the significance value, which is determined through Ancova. In instances where the value lies at or below 0.05, the Null Hypothesis (H0) is rejected, and the Alternative Hypothesis (H1) is accepted. Conversely, if the value exceeds 0.05, the situation is reversed, with H0 being accepted and H1 being rejected. The following section details the results of the Ancova test in this study.

Table 4. Ancova Test of Learning Outcomes

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6137.509a	2	3068.755	61.932	<,001	.821
Intercept	4279.823	1	4279.823	86.373	<,001	.762
Class	890.509	1	890.509	17.972	<,001	.400
Error	5172.861	1	5172.861		<,001	.795
Total	1337.858	27				
Corrected Total	169837.000	30				

The Ancova test results presented in the table demonstrate that the significance value is 0.001, which is less than the 0.05 threshold ($0.001 \leq 0.05$). Consequently, based on the principle of decision-making, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted. In addition, the following presents the mean value of learning outcomes, as shown in Table 5.

Table 5. Test of Mean Value of Learning Outcomes

Class	Mean	Std Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Exsperiment	85.852a	1.760	82.240	89.463
Control	59.527a	1.881	55.666	63.387

As demonstrated in Table 5, the mean value of learning outcomes in the experimental class is 85.852, while the control group achieves an average of 59.527. This finding indicates that the efficacy of the PjBL model, grounded in differentiated learning, surpasses that of the Direct Learning model. Consequently, it can be concluded that the implementation of the PjBL model based on differentiated learning exerts a significant influence on the learning outcomes of 4th grade elementary school students.

DISCUSSION

Project Based Learning (PjBL) is one of the learning methods that provide opportunities for students to learn through the following projects or meaningful problem-based tasks (Chen & Hsu, 2018). According to Lee, et al (2019) stated that the benefits of PjBL in improving science literacy are project-based learning students learn about science concepts through projects or tasks that are meaningful and relevant to the real world. Students not only memorize the material, but also apply it in everyday life.

Therefore, it can be concluded that the implementation of a PjBL (Personalized, Joyful, Basic, Learner) model-based educational approach, grounded in the principles of differentiated learning, exerts a substantial influence on the learning outcomes of 4th grade primary school students. According to Andini (2016), the PjBL model employs a variety of approaches in terms of content, process and product. In a differentiated classroom, teachers are required to pay close attention to three key elements in the implementation of differentiated learning: (1) content (input), which refers to the subject matter students learn; (2) process, which encompasses the methods students use to acquire information and formulate ideas related to the subject matter; and (3) product (output), which refers to the manner in which students demonstrate their learning. According to Heacox in Ditasona (2017) differentiated learning specifically responds to students' continuous learning progress, what they already know and what they are learning. Based on student characteristics, Tomlinson (Ditasona, 2017) suggests that differentiated learning can be done in three ways, namely: (1) learning readiness, if the tasks given by the teacher are in accordance with the students' abilities, (2) learning profile, if the tasks given by the teacher are able to encourage students to learn in the way they like, (3) interest, if the tasks given by the teacher are able to stimulate students' curiosity

and passion for learning. Project Based Learning (PjBL) based on differentiated learning. Learning outcomes are defined as the abilities of students obtained after participating in learning activities (Nugraha, 2020). These outcomes encompass a range of competencies or abilities that students acquire through engagement in the teaching and learning process, incorporating cognitive, affective, and psychomotor skills (Wulandari, 2021). In the opinion of Mustakim (2020), learning outcomes are defined as the achievements of students in relation to specific assessments that have been delineated by the curriculum of a preceding educational institution.

According to Sudjana (2005), as cited by Firmansyah (2015), learning outcomes are defined as alterations in an individual's state that occur as a consequence of the learning process. Drawing upon the insights of multiple experts in the field, it can be posited that learning outcomes are the achievements attained by an individual in the form of alterations in his or her state, consequent to the learning process.

CONCLUSIONS AND RECOMMENDATIONS

The findings of the research indicate that the significance value is 0.001, which is less than 0.05 ($0.001 \leq 0.05$). Consequently, H_0 is rejected and H_1 is accepted. Consequently, it can be posited that the implementation of a Project Based Learning (PjBL) model, underpinned by differentiated learning methodologies, exerts a tangible influence on the academic outcomes of fourth grade students.

In light of the findings and conclusions, the following recommendations are proposed: firstly, that the results of this study be regarded as a point of reference for future researchers; secondly, that the Project Based Learning (PjBL) model be applied to a range of materials or subjects in elementary school, with a view to providing a variety of learning materials. The study has also yielded new experiences in the teaching and learning process, which in turn have become an innovation for teachers in using learning models.

FURTHER STUDY

Researchers limit this research to two problems, namely the effect of the influence of PjBL based on differentiated learning on science literacy and learning outcomes of grade IV elementary school students. Therefore, it is hoped that there will be further research to examine different educational strata so that teachers can have knowledge and skills in applying the PjBL method based on differentiated learning of science literacy and learning outcomes.

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REFERENCES

- Abidin, et al. 2017. Literacy Learning Strategies to Improve Literacy Skills in Mathematics, Science, Reading, and Writing. Jakarta: Bumi Aksara.
- Andini, D. W. (2016). "Differentiated Instruction": Learning Solutions in Diversity of Students in Inclusive Classroom. *Trihayu*, 2(3), 259034
- Anggraeni, R., Zubaidah, S., & Corebima, A. D. (2020). Project-based Science Learning to Improve Science Literacy and Science Generic Skills of Elementary School Students. *Journal of Basic Education Innovation*, 4(2), 128-138.
- Aris Yulianto, A. Fatchan, I Komang Astina. (2017). Implementation of Lesson Study-Based Project Based Learning Model to Increase Students' Learning Activeness. *Journal of Education: Theory, Research, and Development*, 2(3), 448-453.
- Bagiyono. (2017). Analysis of Level of Difficulty and Distinguishing Power of Radiography Training Exam Item Level 1. *Pusdiklat -Jurnal BATAN*. ISSN 1410-5357.
- Chandrawati, T., & Aisyah, S. (2022). Cultivating Environmental Love in Early Childhood Communities. *Aksara: Journal of Nonformal Education Science*, 8(1), 131-136.
- Chen, M. J., & Hsu, Y. S. (2018). A review of definitions and characteristics of project-based learning through the lens of 21st century skills. *EURASIA Journal of Mathematics, Science and Technology Education*, 14(4), 1613-1633.
- Ditasona, Candra. 2017. Application of Differentiated Instruction Approach in Improving Mathematical Reasoning Ability of High School Students. *J.EduMat*. Vol.2, no.1. Pp. 43 - 54.
- Fadilah, F., Isti, S., Amarta, T. W. D., & Prabowo, C. A. (2020). Analysis of Science Literacy Skills of High School Students in Biology Learning Using NOSLit. *Bioeduin Journal: Biology Education Study Program*, 10(1), 27
- Heryanto, D., & Kusumaningrum, I. (2020). Implementation of Project-Based Learning to Improve Students' Science Literacy. *Indonesian Journal of Science Education*, 9(1), 118-127.
- I Wayan Karmana, (2024). Application of Projec based learning (PjBL) model to science literacy skills and student learning outcomes in science learning at school. *Pantera: Scientific Journal of Science Education and Applied*, E-ISSN 2808-246X.
- Iskandar, (2021). Improving Student Learning Outcomes on Report Text Material. *Indonesian Journal of Education and Learning (JPPI)*
- Jenyana, I. M. R., & SD, S. P. (2022). Differentiated Learning. *Innovation Teacher Journal*, 8(17), 31-37.
- Lee, C. Y., Chen, P. H., & Chan, T. W. (2019). Enhancing scientific inquiry with project-based learning through simulation-based virtual experiments. *Journal of Educational Technology & Society*, 22(3), 1-13.

- Maarif, S., & Rustaman, N. (2019). Project-based learning with STEM approach to enhance science literacy. *Journal of Physics: Conference Series*, 1185(1), 012037.
- Meilia, M., & Murdiana, M. (2019). Educators Must be Competency Literate in Facing 21st Century Education. *Al Amin: Journal of Islamic Science and Culture Studies*, 2(1), 88-104.
- Ministry of Education and Culture, (2020). *Driving School and Pancasila Learner Profile*
- Murti, P. R. (2018). Development of Nature of Science (NOS) Based Test Instrument to Measure Science Literacy of High School Students on Newton's Law Material. Doctoral dissertation. Surakarta: UNS (Sebelas Maret 115 University)
- National Academy of Sciences. (2017). Report on science literacy: The state of science education in the United States. Retrieved from
- OECD. (2019). *PISA 2018 Assessment and Analytical Framework*. OECD Publishing.
- PISA 2015 Draft Mathematics Framework. New York: Columbia University.
- Pratiwi, S. N., Cari, C., & Aminah, S. (2019). 21st Century Science Learning with Students' Science Literacy. *Journal of Physics Materials and Learning (JMPF)*, Volume 9 Number 1 2019 ISSN: 2089-6158.
- Purba, Mariati, et al. 2021. Principles of Differentiated Instruction Development, in *Flexible Curriculum as a Form of Independent Learning*. Jakarta: Education Standards, Curriculum, and Assessment Agency, Ministry of Education, Culture, and Research.
- Purwati, S. (2017). Reading Literacy Program 15 Minutes Before the Lesson Starts to Improve Reading Learning Outcomes and Memorize Short Surahs. *Journal of Social Education, Science, and Humanities*, 3(4), 663-670
- Rahayu, R., & Ismawati, R. (2022). The effectiveness of ethnsains-based project-based learning in science learning on students' science process skills during the pandemic. *Journal of Mathematics and Natural Sciences Education*, 682-689. <https://doi.org/10.37630/jpm.v12i4.738>.
- Rerung, N., Sinon, I. L., & Widyaningsih, S. W. (2017). Application of Problem Based Learning (PBL) learning model to improve learning outcomes of high school students on the material of effort and energy. *Scientific Journal of Physics Education Al-Biruni*, 6(1), 47-55
- Santika, I. D., & Khoiriyah, B. (2023). Differentiated Learning and the Relevance of Ki Hajar Dewantara's Pedagogical Vision in Realizing Free Learning. *Journal of Education and Counseling (JPDK)*, 5(1), 4827-4832.
- Sari, R. T., & Angreni, S. (2018). Application of Project Based Learning Model (PjBL) Efforts to Increase Student Creativity. *Journal of VARIDIKA*, 30(1), 79-83. <https://doi.org/10.23917/varidika.v30i1.6548>.
- Septikasari, R., & Frasandy, R. N. (2018). 4C 21st Century Skills in Basic Education Learning. *Tarbiyah al-Awlad*, 8(2), 107-117.