Eduvest – Journal of Universal Studies
Volume 4 Number 07, July, 2024
p- ISSN 2775-3735- e-ISSN 2775-3727

THE INFLUENCE OF PROJECT-BASED LEARNING AND ECO-LITERACY ON STUDENTS' HIGHER-ORDER THINKING SKILLS

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ABSTRACT

The era of globalization brings new challenges and problems that require innovative solutions. Thus, 21st century education requires students to have higher order thinking skills, one of the learning models for developing these skills is Project Based Learning (PjBL) and ecoliteracy. The purpose of this study was to examine the effect of using Project Based Learning (PjBL) and ecoliteracy learning models separately and together on students' higher order thinking skills. This research is quantitative research with quasi-experiment type. Data collection techniques in this study used ecoliteracy questionnaire instruments and higher order thinking skills tests, as well as observation sheets to observe the implementation of the learning model. As for data analysis, this study used descriptive statistical techniques, tested analytical requirements such as normality and homogeneity tests, and applied inferential statistical analysis with two-way Anava. The results showed that Project Based Learning and ecoliteracy together had a significant positive impact on students' higher order thinking skills. This indicates that the use of Project Based Learning and ecoliteracy is more effective in improving students' higher order thinking skills when compared to using only Project Based Learning or learning models alone.

KEYWORDS *Project Based Learning, Ecoliteracy, Skills, Higher Order Thinking*

INTRODUCTION

Higher-order thinking skills have become a benchmark for learning evaluation today, covering students' ability to apply their knowledge to everyday life situations and assess their readiness to interact in society (Malik, 2018). Since the implementation of the curriculum in Indonesia in 2013, the focus has changed towards the development of character and 21st century skills. This is reflected in a

How to cite: Okky Ayu Setyowati, Agung Purwanto, Iva Sarifah. (2024). The Influence Of Project-Based Learning And Eco-Literacy On Students' Higher-Order Thinking Skills. *Journal Eduvest. 4*(7): 5838-5848
E-ISSN: 2775-3727
Published by: https://greenpublisher.id/

learning approach that emphasizes higher order thinking skills, with student centered learning strategies (Fitri et al., 2018; Rahmawati et al., 2021).

Thinking skills are cognitive dimensions that are classified based on the hierarchical process of thinking from concrete to abstract knowledge. According to (Anderson, Krathwohl, et al., 2001), thinking skills include several aspects, including remembering, understanding, applying, analyzing, evaluating, and creating. These skills are then grouped into two levels, namely low-level thinking skills that include the dimensions of remembering, understanding, and applying, and high-level thinking skills that include the dimensions of analyzing, evaluating, and creating (Brookhart, 2010).

The formation and development of higher order thinking skills can begin to be applied at the elementary school level, because this level is the best time to lay the foundation of intelligence and skills (Hayati et al., 2021; Seman et al., 2017). Students who have been accustomed to using higher-order thinking skills will find it easier to manage information, solve problems, and obtain better learning outcomes (Seman et al., 2017). Understanding learning in elementary school will have a very important influence on the next level of education because it is the foundation of students' thinking framework.

Indonesian students' higher-level thinking skills are currently low, students are still weak in understanding complex information, connecting facts and other concepts, reflecting, analyzing, solving problems, theorizing and investigating (Rahmawati et al., 2021). Developing students' higher order thinking skills from elementary to secondary levels has been pursued in the form of a curriculum, but the implementation has experienced several obstacles so that until now students are still at a low level of thinking (Rapih & Sutaryadi, 2018).

The learning process plays a big role in developing higher order thinking skills. The Project Based Learning model is one of the innovative learning models because it is student centered. Project Based Learning (PjBL) derived from the project method coined by Kilpatrick is the right learning model in developing high-level thinking skills because the activities carried out by students in the PjBL learning steps train their thinking development. Starting from students are faced with problems or phenomena, given fundamental questions, design project planning, make a schedule until students evaluate their project experience. These activities require analytical skills in an effort to solve problems/respond to phenomena logically and reflectively, evaluation skills in carrying out project creation and skills in creating ideas as alternative solutions that are realized in a project (Sarifah, 2023; Sularmi et al., 2018).

Ecoliteracy aims to introduce and renew people's understanding of the importance of global ecological awareness. It aims to create a balance between society's needs and the earth's capacity to fulfill them. In this context, ecoliteracy plays an important role in shaping people's understanding of how we can internalize ecological awareness as a guide in our behavior and attitude towards environmental issues. Thus, ecoliteracy is key in dealing with various problems that arise due to a lack of ecological awareness which often causes environmental imbalances (Harlen OBE, 2018; Mufidah et al., 2021). According to (Golemen et al., 2012), there are five aspects that can be improved in shaping ecoliteracy or ecological intelligence.

The five aspects are developing empathy for all forms of life, accepting sustainability as a community practice, revealing the invisible, anticipating unexpected consequences, and understanding how nature maintains life.

Learning in elementary schools with an ecoliteracy approach is closely related to environmental issues. Environmental issues from time to time are increasingly complicated, but the human ability to respond and solve them has not increased in proportion to the increasing complexity of these environmental problems (Purwanto, 2012). Applying ecoliteracy in learning is one of the spaces in building students' higher-level thinking skills, because of the connection of cognitive aspects which are then realized in ecological attitudes, skills and participation (Muhaemin, 2015).

Research conducted by Widiawati et al. (2023) showed that students who have high achievement motivation in project-based learning tend to have better higher order thinking skills compared to students who have low achievement motivation. The research to be conducted by researchers will pay attention to this difference by using the Project Based Learning model and ecoliteracy in improving the higher order thinking skills of Grade V elementary school students. In addition, according to Saputro & Rayahub (2020), students are more motivated and excited in participating in Project Based Learning learning when using monopoly media. They feel motivated to create something they have never done before, so students' curiosity increases and automatically improves their critical thinking skills.

The results of this study can serve as a foundation for the development of a more effective curriculum, as well as the establishment of learning methods that are more relevant to the demands of the times. In addition, the theories used in this study can complement the existing literature in the field of education, especially in the context of developing higher order thinking skills. The purpose of this research is to examine the effect of using Project Based Learning (PjBL) and ecoliteracy learning models separately and together on students' higher order thinking skills.

RESEARCH METHOD

This research uses quantitative methods with quasi-experimental types. Quantitative research is a research method that collects data in the form of numbers and then analyzes it using statistical techniques. This approach aims to measure certain variables and find the relationship between them (Yam & Taufik, 2021). Quasi-experimentation is essentially an experiment but in its implementation it is constrained by the fulfillment of criteria related to random selection of sample subjects and random assignment of subjects so it is called a pseudo-experiment (Ali & Asrori, 2014). This study will use a factorial design with a 2x2 treatment by level two-way analysis of variance technique because it has one or more treatment variables and one dependent variable (Creswell, 2019). Data collection techniques in this study used ecoliteracy questionnaire instruments and higher order thinking skills tests and model implementation observation sheets.

The data analysis method used in this research involves several stages. The first stage was data analysis using descriptive statistics to provide an overview of the data characteristics. The next step involves testing the requirements of the analysis, such as the normality test to evaluate whether the data is normally distributed, and the homogeneity test to check the uniformity of variance between data groups.

The final step involves analyzing the data using inferential statistics using two-way analysis of variance to test hypotheses and draw broader conclusions from the sample data.

RESULT AND DISCUSSION

Normality Test

This normality test is carried out to determine whether the data distribution follows a normal pattern. If the data is normally distributed, so that parametric statistical analysis methods can be applied (Supardi, 2017). Normality testing uses the Shapiro Wilk Test with a significant level (α) of 5% or 0.05, because the data sample used is less than 50.

Table 1. Normality Test Results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
HOTS	.353	10	<.001	.769	10	.324
PjBL	.277	10	.028	.745	10	.113
Ecoliteracy	.380	10	<.001	.739	10	.073

a. Lilliefors Significance Correction

Based on the acquisition of normality testing using Shapiro Wilk in Table 1, the significance value obtained is 0.324 for the HOTS variable, 0.13 for the PjBL variable, and 0.073 for ecoliteracy. Thus, it can be concluded that the three data are normally distributed because > 0.05.

Homogeneity Test

Homogeneity test is one of the testing methods in statistics to determine whether two or more samples from different populations have the same variance distribution or characteristics.

Table 2: Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
PjBL	Based on Mean	2.517	14	94	.114
	Based on Median	1.354	14	94	.192
	Based on Median and with adjusted df	1.354	14	55.043	.208
	Based on trimmed mean	2.413	14	94	.106
Ecoliteracy	Based on Mean	2.070	14	94	.070
	Based on Median	.995	14	94	.465
	Based on Median and with adjusted df	.995	14	66.554	.469
	Based on trimmed mean	1.959	14	94	.030
HOTS	Based on Mean	2.758	14	94	.082
	Based on Median	.868	14	94	.595

Based on Median and with adjusted df	.868	14	30.539	.597
Based on trimmed mean	2.507	14	94	.234

Based on Table 2, it is known that the third data has a significance of 0.114 then 0.70 then 0.30 so that > 0.05, it can be concluded that the three data have the same group variance or homogeneous.

Two Way ANOVA Test

Two-way ANOVA testing is a statistical method used to evaluate the effect of two categorical predictor variables on a continuous response variable.

Table 3. Two Way ANOVA Test Results

Dependent Variable: HOTS					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	418.850[a]	6	69.808	5.699	.091
Intercept	38677.152	1	38677.152	3157.319	<.001
PjBL	155.856	2	77.928	6.361	.083
Ecoliteracy	297.647	3	99.216	8.099	.060
PjBL * Ecoliteracy	145.558	1	145.558	11.882	.041
Error	36.750	3	12.250		
Total	57912.000	10			
Corrected Total	455.600	9			
a. R Squared = .919 (Adjusted R Squared = .758)					

From table 3, the significance value for the use of *Project Based Learning* and ecoliteracy is 0.041, which means the value is <0.05. Based on this, it can be concluded that the use of *Project Based Learning* and ecoliteracy has a significant interaction effect on improving students' higher-level skills.

Project Based Learning Affects Students' Higher Level Thinking Skills

The results showed that PjBL had a significant impact on the development of higher order thinking skills. There are various models that can be used in the teaching and learning process so as to enhance the growth of students' creative spirit, especially in the context of creating and making a product or work. One learning approach that is recognized to advance students' creativity and creative thinking skills in the process of designing and producing a project is project-based learning, better known as PjBL. This PjBL gives time for educators so that they can organize the learning process in the classroom by linking to various projects (Sastradiharja & Febriani, 2023).

PjBL is a model of teaching and learning that actively connects the use of various technologies related to real-life situations through the implementation of projects that help in creating products or works. In PjBL, students are independently involved in trying to improve their thinking skills, especially critical thinking, by tackling problems that confront them. This PjBL approach helps students to be able to create their own tasks as well as use the data they obtain to apply it in their real-

life context. Thus, project learning makes students gather various useful insights and abilities (Riza et al., 2020). Project-based learning, as a learning model, presents real-life situations, authentic problems, and the resources needed to find their own solutions and conclusions. Students have the responsibility to plan their own learning, cooperate with their peers, and complete tasks at their own pace (Mones et al., 2023).

According to Alhayat et al. (2023), the characteristics of the project-based learning model are:

a. students have the freedom to determine various pre-defined in-class activities;
b. students gain experience in solving cases that can be solved through projects;
c. Students participate in planning activities so that their activities can be implemented to reach a solution;
d. students are facilitated in expressing their various thoughts;
e. students take responsibility for obtaining and managing all the information they collect;
f. involves experts in specific fields related to the project;
g. evaluation is carried out with regularity on project activities;
h. students are given the opportunity to review the activity they did;
i. the final product of the project is diverse;
j. creating a learning environment that accepts mistakes and changes.

According to Aldabbus (2018), the advantages of PjBL are: 1) Related to real world problems; 2) Develops various skills, but also psychomotor and social-related abilities of students; 3) Improves student learning outcomes; 4) Generates student interest not only in certain topics, but also helps them understand and internalize key concepts in depth; 5) Encourages active student participation in collaborative cooperation that produces authentic products. Meanwhile, the shortcomings of the Project Based Learning (PjBL) model for teachers include several things, namely: 1) Teachers may feel less confident in implementing PjBL because they may feel inexperienced or unmotivated; 2) Project implementation requires a lot of time; 3) Time is limited.

Constructivism, as a widely accepted learning theory, emphasizes that students construct their own knowledge through their personal experiences. Project-based learning naturally supports the principles of constructivism by creating an environment where students can develop knowledge and skills personally. Vygotsky's social constructivism theory also supports project learning by emphasizing the importance of interaction between individuals in the development of cognition. With the use of PjBL learners can share ideas, listen to others' perspectives, and reflect on their own ideas, all of which are forms of individual empowerment (Khairini et al., 2022).

Constructivism promotes learning activities that enable students to improve higher order thinking. In a constructivist approach, learners are encouraged to engage in teaching and learning activities, consider and reflect on the material being studied, and construct their own understanding through interaction with the material. By participating in activities that stimulate critical thinking, such as discussing ideas, solving problems or completing projects, students can improve their higher-order thinking skills. Students can differentiate between problems,

analyze and draw complex conclusions. In this context, constructivism acts as a framework that supports the development of higher order thinking by inviting learners to be active participants in their own learning activities, rather than passive recipients of information.

Higher order thinking skills have a significant impact on the quality of one's life. In this era of globalization, higher order thinking skills are an inescapable necessity; thinking alone is not enough, but the ability to think critically and creatively is essential. The inability to think at a higher level can result in instantaneous behavior and a lack of resilience in dealing with the realities of life. When one's mind is dulled, difficulties in adjusting, seeking alternatives, and feeling stuck can hinder life's progress. Therefore, mastering higher-order thinking skills early on, especially in educational settings, will help learners excel in the future in solving life's challenges. These skills allow them to look at every problem logically, giving them strong motivation to seek effective solutions (Irawati & Mahmudah, 2018).

Thus, *Project Based Learning* (PjBL) directly supports the improvement of students' higher order thinking skills. In PjBL, learners are given the opportunity to be actively involved in planning, managing, and completing projects that require complex problem solving. Through this process, students are given the space to apply various aspects of higher-order thinking such as analysis, evaluation, and synthesis in a real context. They are also encouraged to think critically, solve problems, collaborate with peers, and communicate effectively. Thus, PjBL provides a learning environment that allows students to hone and develop their higher-order thinking skills, thus directly influencing the improvement of students' abilities in critical, creative, and analytical thinking.

Ecoliteracy Affects Students' Higher Order Thinking Skills

The results showed that ecoliteracy has a significant impact on students' higher order thinking skills. Through educational institutions, it is important to convey knowledge in awareness of protecting the surrounding nature so that it remains and is sustainable. Ecoliteracy cannot be realized as a form of knowledge that everyone gets through various literatures, because literacy activities are a means for individuals to realize and care about existing problems (Ramadhan & Sujanti, 2022). Ecological literacy is a condition in which individuals have gained various insights well into the surrounding nature with good things happening to the surrounding nature itself. Individuals who have ecological literacy realize that the environment needs to be preserved because it acts as an ecosystem for all living things. Ecological literacy is important for all humans in order to preserve the environment as an ecological system is maintained. Ecological literacy has 6 things that are needed including implications, knowledge of ecology, socio-political knowledge, knowledge of environmental issues, cognitive abilities, and environmentally responsible behavior. (Wijaya et al., 2021).

Ecoliteracy is a form of literacy that focuses on the relationship between humans and the environment to be the main focus in supporting sustainable development, so that students can have a deep understanding of the environment and develop a positive attitude towards it. The development of ecoliteracy skills can

be done either through an integrated approach or a separate approach in the learning process in the classroom. Thus, environmental awareness in students can be formed early on, enabling them to have a high level of awareness in caring for the environment (Tyas et al., 2022).

Ecoliteracy is the main basis in understanding and applying knowledge related to the balance between living things and the environment, with the aim of achieving a sustainable and balanced life. Through ecoliteracy, individuals strive to understand the importance of preserving the environment, based on a high awareness of the importance of balanced interactions in the environment and its contents (Setiawati et al., 2020; Sucia et al., 2018). Students who have a high level of ecoliteracy will understand how to apply the principles of justice for themselves, others, and the surrounding environment. They tend to analyze and carefully consider the actions they take. This shows a close relationship between ecoliteracy and higher order thinking skills. The role of ecoliteracy is crucial in raising awareness of the importance of maintaining environmental balance and conserving natural resources. Through ecoliteracy, an understanding of the importance of global ecological awareness is enhanced, aiming to achieve a balance between human needs and the earth's capacity to support them. Therefore, it is important to include ecoliteracy learning in the primary school curriculum (Lavasani & Khandan, 2021).

Thinking skills play a crucial role in learning success. Students are one of the productive assets of human beings, therefore, the quality of their thinking needs to develop abilities in order to compete according to the times. One aspect of thinking that is crucial for students is the ability to think at a higher level, which includes various thinking skills (Amalia & Pujiastuti, 2020). In improving higher-order thinking, learners need to understand various facts, concepts, and procedures, then implement them in learning with various actions that reflect the process that produces solutions. Teachers can help develop students' higher-order thinking skills through a number of activities, such as observation, concept formation, providing responses, analysis, comparison, and providing the necessary considerations (Fitri et al., 2018).

Ecoliteracy has a significant impact on the development of students' higher order thinking skills. By understanding the complexity of the relationship between humans and the environment and the concept of sustainability, students are invited to use their critical, analytical and creative thinking skills. Through ecoliteracy, students learn to question assumptions, analyze environmental problems, and design innovative solutions. They are also trained to see the environment as an interconnected system, requiring deep systemic thinking. In addition, ecoliteracy encourages concrete actions to improve the environment, requiring careful planning and implementation involving students' higher-order thinking skills. Thus, ecoliteracy not only improves students' understanding of the environment, but also helps them develop critical, analytical, creative and systemic thinking skills that are essential in facing global sustainability challenges.

The implementation of *Project Based Learning* and ecoliteracy in the context of basic education can be applied to the subjects of Natural and Social Sciences (IPAS) in the independent curriculum. IPAS learning in elementary school students

is still limited to learning resources in the form of textbooks or texts, not direct learning related to problems that occur in the surrounding environment as a result of ecological interactions, besides that another problem is that learning is still teacher-centered (Kristyowati & Purwanto, 2019).

CONCLUSION

The use of Project Based Learning (PjBL) and ecoliteracy learning models simultaneously has a significant positive impact on the development of students' higher order thinking skills. This finding illustrates that PjBL combined with ecoliteracy principles can be more effective in improving students' higher order thinking skills when compared to the application of PjBL or conventional learning methods alone. PjBL and ecoliteracy learning models provide a more meaningful context for students, allowing them to develop critical, creative, and analytical thinking skills in a context relevant to their surrounding environment. Therefore, the results of this study provide a deeper understanding of the importance of incorporating ecoliteracy aspects in learning design to strengthen educational effectiveness in improving students' higher order thinking skills.

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