



# Project-Based Learning: Butterfly Diversity Survey In Sekolah Alam Indonesia

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**Abstract.** Project-based learning (PBL) is a form of student-centered teaching that is good for science learning activities with specific characteristics. Sekolah Alam Indonesia Cipedak chose the EMPANG restoration theme by observing butterfly diversity as the main project in its curriculum to provide a more contextual and meaningful learning experience in implementing PBL activities at this nature school. PBL activities were carried out for three months from January to March 2023 at Sekolah Alam Indonesia Cipedak Mampang Campus. There were 44 students participating in PBL, divided into five different groups. Each group had 8-9 members. Each group was accompanied by a facilitator from research planning to follow-up data collection efforts. Data collection of butterfly species in PBL activities used the exploration method by walking slowly as far as 1,500 m<sup>2</sup> to look for butterflies. Students and facilitators together produce an agreement from the survey of problems to carry out project-based learning. The types of butterflies in SAI Cipedak Mampang Campus that are dominantly found have dark patterns and colors so that they are not easily seen by predators and adapt well to grass or shrub habitats and flower gardens. Students made follow-up activities such as 1) butterfly photo exhibition activities; 2) talk show activities; 3) drama performances; and 4) making flower gardens.

**Keywords:** project-based learning, biodiversity, butterflies, sekolah alam indonesia, student-centered learning.

## 1 Introduction

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and state [1]. One of the factors that can influence the success of education is the readiness of teachers to prepare students through the learning process [2]. Teachers can use learning models that are appropriate to the subject matter. An innovative learning model that provides opportunities for students to express ideas and ideas in one work so as to develop creativity and improve student learning outcomes is project-based learning [3].

Project-based learning (PBL) is a good form of student-centered teaching in science learning activities with specific characteristics [4][5][6][7] that can be used by focusing on coherence, depth, and motivation [8]. PBL learning in which students are actively involved in real projects or constructive research that demands to apply learning objectives, work together, communicate, and share knowledge and understanding to achieve meaningful results [9]. In addition, the PBL learning model can also develop and explore the hidden potential of students [10].

Project-based learning offers opportunities for collaboration, extensive feedback and student-driven experiences both independently and collaboratively with peers while collecting, analyzing data and building problem solutions into action [11][12][13]. The implementation of

project-based concept development can improve the understanding of relationships and experiential reasoning of learners in schools [9] and can help students understand scientific knowledge [5].

Nature school is an alternative education that uses nature as the main medium for student learning [14], which does not only teach theory to students, but is given the freedom to learn to explore the environment directly [15]. In general, the concept of natural school education has three functions, namely: nature as a learning space, nature as a medium and teaching material, nature as an object of learning [14]. Sekolah Alam Indonesia (SAI) Cipedak is the first natural school in Indonesia, which prioritizes the concept of education in three materials, namely 1) akhlakul karimah (attitude of life), 2) leadership training, and 3) philosophy of science (logic of thinking [16].

The learning process that takes place in nature schools is tailored to the competencies that students already have [17]. Sekolah Alam Indonesia Cipedak uses a PBL approach that creates an engaging learning environment that is student-centered, and encourages students to become lifelong learners. Teachers and students have agreed to choose the EMPANG (ecology, mission sustainable, productive, social at Mampang) restoration theme by observing butterfly diversity as the main project in the curriculum to provide a more contextual and meaningful learning experience in implementing PBL activities at this nature school.

Students engage in various tasks in this project, such as identifying different species of butterflies, learning about butterfly migration and habitats, and analyzing environmental factors that affect butterfly populations. Thus, this project will have two benefits: improving students' understanding of the environment and the importance of conservation, and also providing valuable data for scientific research and environmental conservation.

## 2 Methods

PBL activities were carried out for three months from January to March 2023 at Sekolah Alam Indonesia Cipedak, Mampang Campus. There were 44 students participating in PBL, divided into five different groups. Each group had 8-9 members. Each group was given 15 minutes in turn to observe the types of butterflies in each zone. Each group was accompanied by a facilitator from research planning to follow-up efforts to collect data. Students are guided to collect data once a week for up to 12 weeks or 12 times. The implementation of this project has several stages, including: 1) research planning and pre-survey preparation, 2) guided observation, 3) data collection, 4) identification process, and 5) follow-up efforts [18]. Implementing these stages, students are trained to be active and creative thinkers and engage in collaborative learning to work on group projects [19].

Data collection of butterfly species in PBL activities using the exploration method [20][21], by walking slowly as far as 1,500 m<sup>2</sup> to look for butterflies which were divided into five zones, including: 1) the zone around the classrooms with flower gardens; 2) the zone near the pond area; 3) the zone around the musholla and the spring that drains the pond; 4) the zone around the garden; and 5) the field zone surrounded by grass. When butterflies were found, data were recorded on the number of individuals, species, and activities. In addition, the type of food plant that was being sucked by the nectar was also recorded. Learners did not capture the butterflies, but only photographed them as documentation and identification process. The book used by students to carry out the identification process is butterflies botanical garden [22]. The data

analysis used in this study is description. Learners will present the results of the survey to one school in a follow-up activity.

### 3 Result and Discussion

Research planning activities and pre-survey preparation were carried out one month before data collection took place. Students were given a question that could stimulate them to think about the problems that occur in their environment, for example: what will we do to maintain the ecosystem of SAI Cipedak, Mampang Campus so that a green area and fauna are preserved? What are the negative impacts that arise, if the pond ecosystem is polluted? Providing questions given by teachers to students is expected to increase inspiration in solving environmental problems [23].

Each team surveyed the five predetermined zones in the research area accompanied by a facilitator to see and record problems directly in the environment by documenting using tools such as cellphones and cameras. In addition, each team prepares equipment that will be used in the implementation of the project. The facilitator and learners come up with an agreement that the research will be carried out.

Facilitators together with students collect butterfly data at SAI Cipedak Mampang Campus using insect nets by filling in the observation sheets that have been provided. When the facilitator accompanies students, there are a few obstacles in the field, namely students who get tired easily and not enough butterfly fishing gear. Existing obstacles must be reduced to maximize existing potential and teachers can be creative by combining several learning models and methods in achieving the desired learning objectives [9]. Facilitators together with students review the role of butterflies for the ecosystem. The mentoring process by facilitators in the field can provide greater knowledge for students so that their experience will develop [25].

Facilitators and learners together carry out the butterfly identification process from live butterfly samples. The butterfly identification process is carried out by looking at morphology and matching images using a butterfly field guide book. After the identification process, the butterflies are released back into nature so that their sustainability is well maintained.

Table 1 shows that the results of the identification of butterfly species at SAI Cipedak Mampang Campus obtained 169 individuals with 27 species and four families. During the three months of observation, the number of butterfly species found by students varied. The most species of butterflies found were in February as many as 23 species which were divided into two species from the Papilionidae family, 16 species from the Nymphalidae family, three species from the Pieridae family, and two species from the Lycaenidae family. The types of butterflies found in January were 12 species and in March the number was less at 10 species. This is because in February, many flowering plants (*Ageratum conyzoides*, *Tagetes erecta*, and *Bellis perennis*) in the school area were flowering so that it attracted butterflies to come to land and suck flower nectar. The process of taking flower nectar by butterflies can help pollinate plants. [18] mentioned that the presence of wildlife such as butterflies is very important in helping long-term conservation.

**Table 1.** Species of butterflies obtained at SAI Cipedak, Mampang Campus

No	Family	Species of butterflies	Bulan	No	Family
	P0 (0%)	2,4	Jan-uary	100	100
1	Papilio	<i>Papilio demoleus</i>	4	1	Papilio

2	-nidae				
3		<i>Papilio memnon</i>	1	2	
3		<i>Graphium sarpedon</i>	0	3	
4	Nymp-halidae	<i>Hypolimnas bolina</i>	7	4	Nymp-halidae
5		<i>Hypolimnas misippus</i>	0	5	
6		<i>Modusa procris</i>	0	6	
7		<i>Doleschallia bisaltide</i>	0	7	
8		<i>Junonia orithya</i>	2	8	
9		<i>Junonia iphita</i>	2	9	
10		<i>Junonia hedonia</i>	1	10	
11		<i>Junonia alamana</i>	1	11	
12		<i>Junonia atlites</i>	0	12	
13		<i>Ypthima horsfieldii</i>	6	13	
14		<i>Ypthima philomena</i>	0	14	
15		<i>Ypthima nigricans</i>	0	15	
16		<i>Ypthima pandocus</i>	0	16	
17		<i>Euploea eunice</i>	0	17	
18		<i>Euploea mulciber</i>	0	18	
19		<i>Melanithis leda</i>	0	19	
20		<i>Neptis hylas</i>	0	20	
21		<i>Elymnias hypermnestra</i>	0	21	
22	Pieridae	<i>Appias olferna</i>	8	22	Pieridae
23		<i>Eurema hecabe</i>	0	23	
24		<i>Eurema blanda</i>	1	24	
25	Lycac-nidae	<i>Zizinia otis</i>	2	25	Lycac-nidae
26		<i>Parnara bada</i>	1	26	
27		<i>Potantus omaha</i>	0	27	
	Number of Individuals	36	113		Number of Individuals
	Number of Spesies	12	23		Number of Spesies

The most common butterfly species obtained at SAI Cipedak Mampang Campus are *Junonia orithya* as many as 31 individuals, *Appias olferna* as many as 31 individuals, *Ypthima horsfieldii* as many as 14 individuals, and *Hypolimnas bolina* as many as 13 individuals. The types of butterflies in SAI Cipedak Mampang Campus have dark patterns and colors so that they are not easily seen by predators and adapt well to grass or shrub habitats and flower gardens in the process of looking for food plant sources and resting places to perch on trees. [26] mentioned that butterflies have very important ecological benefits that can be used as indicators of ecosystem health. The number of butterflies in a place indicates the quality of the environment is still good.

Follow-up conducted by students by making a celebration in which there are four series of activities, including: 1) butterfly photo exhibition activities carried out by each team by printing their best documentation results and explaining to other teams and exhibition visitors about the role of butterflies in the ecosystem; 2) talk show activities carried out by students by sharing their experiences and discussions after conducting research at SAI Cipedak Mampang Campus; 3) each student has a role in a drama performance on the topic of the environment; and 4) making a flower garden so that it becomes a source of food and can attract the presence of more butterfly species in the SAI Cipedak Mampang Campus environment.

## 4 Conclusion

Students and facilitators together produce an agreement from the survey of problems to carry out project-based learning. The butterfly species in SAI Cipedak Mampang Campus that are dominantly found have dark patterns and colors so that they are not easily seen by predators and adapt well to grass or shrub habitats and flower gardens. Students made follow-up activities such as 1) butterfly photo exhibition activities; 2) talk show activities; 3) drama performances; and 4) making flower gardens.

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