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# IMPROVING STUDENT LEARNING INDEPENDENCE THROUGH A PROJECT-BASED LEARNING MODEL: A CASE STUDY ON CREATING HERBARIUM NAME CARD PRODUCTS

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## Abstract
The independence of student learning is a crucial factor in determining the success of students' educational journey. However, it is evident that many students still need to develop greater independence in their learning process. This research aims to assess the effectiveness of the project-based learning (PjBL) model in enhancing student learning independence (SLI). The study follows a quantitative research approach, employing a quasi-experimental method. The research design utilized a pretest-posttest group design. The participants in this study were students from year seven, specifically class B and D of LHI Islamic Junior High School during the first semester of the academic year 2022/2023. The selection process involved the use of the classroom random sampling technique. The findings indicate that implementing the PjBL model, specifically through a herbarium project in science learning, resulted in an improvement in SLI. This was primarily due to the requirement of independent work in completing individual projects. Moreover, future endeavors should consider incorporating additional activities that foster collaboration among students, allowing them to balance independence and teamwork in project completion.

**Keywords**: herbarium, independent learning, PjBL

## Introduction
The learning process is an important aspect of education (Sayekti et al., 2019). Learning science is inseparable from the dimensions of skill acquisition, the mastery of scientific products, and the development of a scientific attitude (Aisah, 2020). To ensure effective learning of science, it is necessary to engage in the scientific process, which involves conducting experiments, generating scientific products, and cultivating the appropriate attitude (Sulthon, 2017). Furthermore, science learning should be connected to the everyday lives of learners, enabling them to perceive science as relevant and applicable to their daily experiences (Rohandi, 2017); (Syafiani, 2017). Engaging in observation and research-oriented

science learning allows students to explore scientific concepts, making the process of learning science enjoyable (Sulthon, 2017); (Ma et al., 2014).

One of the expected outcomes in science learning is the development of student learning independence (SLI) (Aulia et al., 2019). It is crucial for educators to have a deep understanding of SLI in order to design appropriate learning activities that can yield optimal results (Suharto Linuwih, 2015). Independent learning is a self-directed activity where children take the initiative, demonstrate willpower, and assume responsibility for completing their tasks (Laksana & Hadijah, 2019); (Aini & Taman, 2012), and do not rely on others (Isnaeni et al., 2018). Learning independence enables learners to acquire 21st-century skills such as critical and creative thinking, communication collaboration skill, and literacy authorization (Astriani & Widjaja, 2020). Indicators of learning independence include self-confidence, active learning, learning discipline, and responsibility (Rahayu et al., 2020).

The reality is that SLI remains low (Afandi, 2013); (Gusnita et al., 2021), especially in the context of post-pandemic learning (Nurjanah et al., 2022); (Yahya & Warmi, 2021). One of the causes of low learning independence is the lack of learning experiences that engage and activate students (Rizkianingsih et al., 2013).

Based on interviews conducted with science teachers at middle schools in Yogyakarta, it was observed that students exhibited low motivation in their learning process. Furthermore, students need to develop more confidence in expressing their opinions. In addition, student responsibility appears to be lacking when assigned group learning tasks. As a result, there is a pressing need for innovative teaching methods that facilitate effective educator-student interactions and enhance students' abilities, all while fostering a sense of independence among learners.

The Project-based Learning (PjBL) model fosters constructivist and collaborative learning approaches. This student-centered model places emphasis on collaboration among students to solve problems and construct knowledge collectively. It promotes an environment where students can learn from one another and actively participate in the learning process (Whatley, 2012). PjBL is an instructional approach that engages students in problem-solving activities through carefully designed projects. By actively participating in these projects, students have the opportunity to construct knowledge and create valuable outputs (Mayuni et al., 2019). The syntax of PjBL includes analyzing problems, creating plans, developing project completion schedules, monitoring project progress, and submitting the final project results (Cholifah et al., 2019).

PjBL is effective in enhancing SLI (Martiani, 2021). Moreover, it has been proven that creating science demonstrations, which is a form of PjBL, can invigorate classroom dynamics and foster stronger connections between teachers and students (Widiyatmoko & Pamelasari, 2012).

One of the suitable science learning topics for year seven, which can be effectively taught using the PjBL model, is the classification of living things. The objective of this topic is to enable students to identify the characteristics of living things and classify them accordingly. The classification of living things falls under the category of theoretical knowledge. By implementing the PjBL approach, it is anticipated that the learning experience will become more meaningful and engaging (Setyowati & Mawardi, 2018) because students engage in meaningful activities that go beyond mere theory memorization.

Therefore, in this study, there is a significant requirement to implement the PjBL model in the science learning material focusing on the "Classification of Living Things." It is anticipated that the adoption of this model will lead to an improvement in SLI.

## Method

This research utilized a quantitative approach employing a quasi-experimental research method. The design of this study aimed to create a more natural setting, as opposed to a laboratory-based manipulation, which means that not all variables could be controlled or manipulated (Cohen et al., 2007). This research utilized a pretest and posttest group design with one research class. Initially, students underwent a pretest to assess their baseline levels of learning independence. Subsequently, the students received the treatment, which involved learning using the PjBL model. Following the treatment, a posttest was administered to evaluate any changes in the SLI scores. The pretest and posttest assessments were conducted to compare the students' learning independence levels before and after the implementation of the treatment. This research design is illustrated in Figure 1.

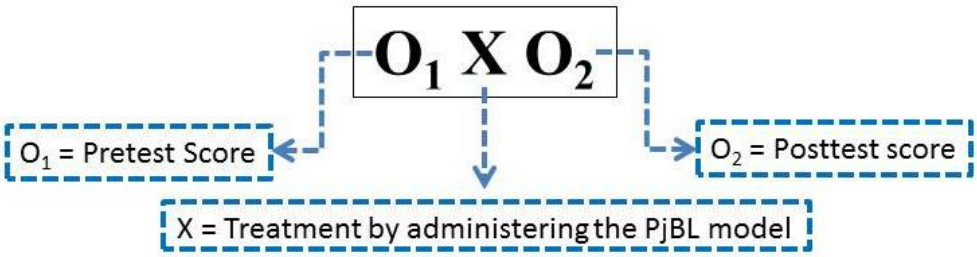


Figure 1. One group pretest posttest research design

This research focused on the topic of "Classification of Living Things." Its objective was to examine the potential increase in SLI through the implementation of the PjBL model. The target population for this study comprised year seven students at LHI Islamic Junior High School during the academic year 2022/2023, involving two classes. The research sample consisted of 33 students from classes VII B and VIID, selected using a cluster random sampling technique.

This study employs two independent variables, namely the PjBL learning model, as treatments given to students, and SLI as the dependent variable. The learning process with the PjBL model is conducted over four sessions.

Observation sheets and Google Form questionnaires were utilized as instruments in this study. The observation sheets consisted of two types: one for assessing the implementation of learning with the PjBL model and another for evaluating student learning independence (SLI). The observation sheet for the PjBL model ensured that all aspects of the model's syntax were properly implemented during the learning process. On the other hand, the Google Form questionnaires were employed to gather data on students' perceptions of PjBL, SLI, and additional relevant information. The recorded data from the observation sheet for the implementation of the PjBL process can be found in Table 1, while the data from the SLI observation sheet can be found in Table 2.

Table 1. Observation sheet on the implementation of the PjBL learning model

| No. | PjBL Syntax | Item Number |
|---|---|---|
| 1 | Analyze and solve problems | 1,2,3 |
| 2 | Create a problem solving plan | 4,5 |
| 3 | Develop a project completion schedule | 6,7,8 |
| 4 | project monitoring | 9,10 |
| 5 | delivery of the final results of the project task | 11,12 |

SLI observation sheets are utilized to gather data on students' learning independence. These observation sheets consist of ten statements that are observed throughout the learning process. The instructor observes SLI while they engage in learning activities. This observation is conducted in two conditions: before the application of the PjBL model (pretest) and during learning with the PjBL model.

Table 2. Observation sheets for SLI

| No. | Indicator | Item Number |
|---|---|---|
| 1 | Self-confident | 1,2 |
| 2 | Learning Activeness | 3,4,5 |
| 3 | Study Discipline | 6,7 |
| 4 | Responsibility | 8,9,10 |

Data analysis was conducted using the normality test and paired t-test, with the assistance of SPSS software for scientific processing. Prior to conducting the t-paired test to validate the hypothesis, a normality test was performed as a prerequisite. This test aimed to determine if the distribution of group data was normal. The data is considered normal if, at a significance level of 5% (0.05), the sig. > 0.05. If the normality test requirements were met, the analysis proceeded with the t-paired test.

T-paired t-test analysis was conducted on the scores of SLI before and after implementing the PjBL treatment model. The hypothesis for this analysis is as follows.

$H_0$ = there is no difference in SLI before and after being given treatment with the PjBL model treatment.

$H_a$ = there are differences in SLI before and after being given treatment with the PjBL model treatment.

The significance level chosen for the t-paired test analysis in this data analysis was 5% (0.05), corresponding to a 95% confidence level, adhering to the research standards in the field of education. It is considered that there is a significant difference in SLI before and after the implementation of the PjBL treatment model if the results of the paired t-test analysis indicate a p-value of less than 0.05 or if the calculated t-value is greater than the critical t-value from the t-table.

## Findings and Discussion

This study aimed to enhance SLI through a project-based activity of creating herbarium-based name cards. The research was carried out at LHI Islamic Junior High School, specifically with the year VII students, during the odd semester of the academic year 2022/2023. The study focused on students from class B and D, with a total of 33 participants.

The teacher organized the students into groups for the implementation of learning with the PjBL model. Each group comprised 4 to 5 students. The teacher randomly assigned the students to groups to ensure variations in terms of academic performance and character among the groups. The groups were identified by assigning numbers 1 to 4. However, during the initial stages of the learning process, it was observed that students often forgot their group members and their respective group numbers when asked to gather in their groups.

The subsequent step involved assigning names to the groups based on the Latin names of plants found in the vicinity of the school. The group names chosen were *Triphasia trifoliata*, *Phyllanthus reticulatus*, *Rosa centifolia*, and *Moringa oleifera*. The selection of plant names was made by the teacher, taking into account the different types of plants present in the school's surrounding environment. Furthermore, the teacher emphasized the selection of plants with small leaves to ensure they would fit on a herbarium card. Once the problem-solving plan had been prepared as a herbarium card, the subsequent step involved developing a project completion schedule. The project completion schedule is detailed in Table 3.

Table 3. Project completion schedule

| No. | Activities | Completion Time |
|---|---|---|
| 1 | Looking for one type of plant to be used as a group name | 1 hour lesson August 2022 fourth week |
| 2 | Drying the leaves of the plant for one week | 1 week between the fourth week of August 2022 to the first week of September 2022 |
| 3 | Preparing the cards that will be used to attach the herbarium leaves | 1 hour September 2022 first week |
| 4 | Writing down the name of the group and stick herbarium leaves on the card | 1 hour September 2022 first week |
| 5 | Laminating the cards | 1 hour September 2022 first week |

The steps that had been implemented in the implementation of learning included: a. determine student groups with code numbers 1-4, b. the group is looking for a plant to be used as a group name, c. the group dried the plant leaves for one week, d. the group writes the group name and attaches herbarium leaves to the card, e. name card laminating group, f. groups use name cards in science learning activities. The detail process of making herbarium-based name cards is shown in Figure 2.

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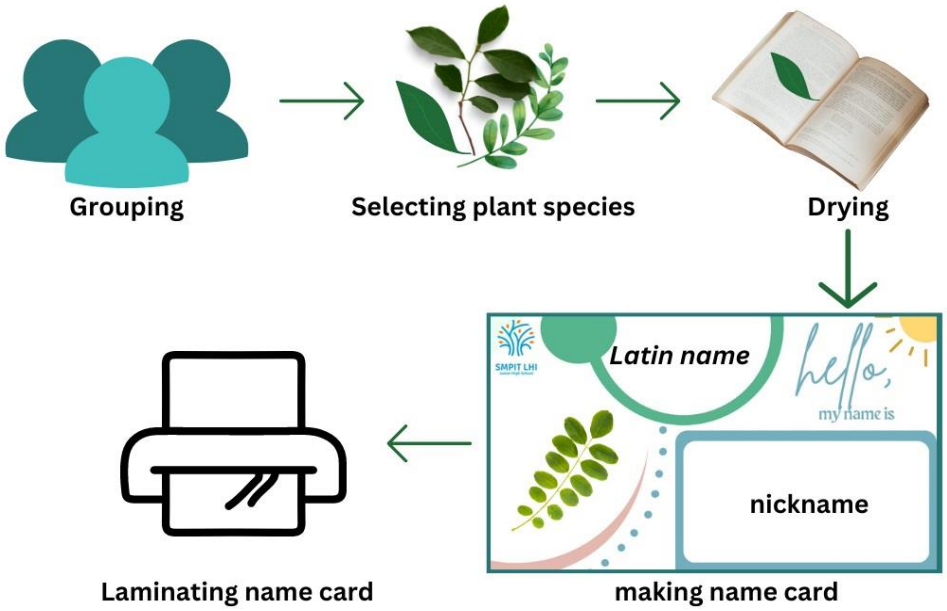


Figure 2. The process of making herbarium-based name cards

The herbarium name cards that were created were subsequently utilized in science learning activities. Students attached the name cards to their chests using safety pins. It was mandatory for students to wear the name cards during every science lesson. The science learning process was designed to incorporate a range of independent and group activities, enabling students to become accustomed to using their name cards in every lesson. This facilitated the teachers in identifying students by directly reading their name cards. Figure 3 showcases pictures documenting the card-making process by the students, as well as the resulting name cards.


Figure 3. Documentation of the process and results

While making herbarium-based name cards, it was observed that students were actively and skillfully engaged in tasks such as drying herbarium leaves,

writing the Latin names of plants, and completing the cards. PjBL could effectively activate students' learning (Dharmayani, 2021); (Ramadianti, 2021). Students also experienced a sense of challenge while creating name cards, as it necessitated independence and accuracy in tasks such as writing, cutting, and laminating. This observation aligns with the argument that PjBL fosters students' development of independence in learning (Martiani, 2021); (Devi et al., 2019). Group projects not only enhance SLI, but they also foster the development of valuable collaboration skills among students (Pebrianti et al., 2021); (Pratiwi et al., 2018). This is attributed to the implementation of project-based learning in groups, which facilitates meaningful student interaction during project completion.

Table 3. SLI scores

| Score | Pretetest | Posttest Meeting- | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Average |
| Lowest Score | 60 | 85 | 83 | 83 | 83 | 83.5 |
| Highest Score | 90 | 95 | 95 | 95 | 91 | 94 |
| Average | 75 | 89 | 88 | 89 | 89 | 88.75 |
| Standard Deviation | 5.11 | 4.22 | 3.39 | 3.97 | 2.78 | 3.59 |

During the implementation of the herbarium card project, the teacher closely monitored SLI. The learning process, using the PjBL model, spanned four sessions. Data pertaining to students' independent learning, observed throughout the learning process, is presented in Table 3. Based on these scores, the difference in students' learning independence scores between the pretest (before implementing the PjBL model) and posttest (after implementing the PjBL model) is graphically depicted in Figure 4.

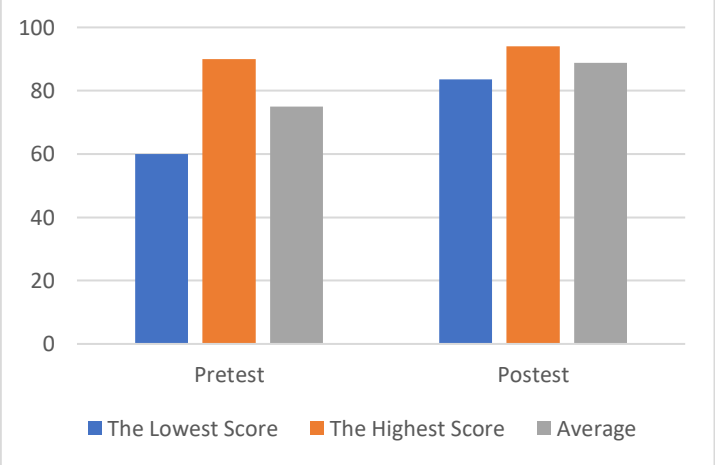


Figure 4. Scores of SLI in the pretest and posttest

In addition, a statistical analysis was conducted to determine whether there is a significant difference in SLI scores before and after implementing the project-based learning (PjBL) model. The T-Paired Test was utilized for this hypothesis test, preceded by a normality check as a prerequisite. The results of the normality check are presented in Table 4.

Table 4. Normality test

| Hypothesis Prerequisites Test | Significance Value |
|---|---|
| Normality Test | 0,053 |

The normality test conducted on the data related to student learning concentration, as shown in Table 4, yielded a significance value of 0.533 or sig.> 0.05. These results indicate that the data follows a normal distribution. As the data met the assumption of normality, the hypothesis could be tested accordingly. The results of the T-paired test for the hypothesis can also be found in Table 5.

Table 5. T-Paired test

| Variable | Sig. (2-tailed) |
|---|---|
| SLI | 0,001 |

The results presented in Table 5 indicate that the T-Paired Test yielded a significance value of 0.001, with a sig value (2-tailed) < 0.05. These findings reveal that the treatments resulted in significant differences in SLI between the pretest (before treatment) and the posttest (after treatment).

Table 6. Student responses to the media and learning implemented

| No. | Statements | Answers | |
|---|---|---|---|
| | | Yes | No |
| 1 | Herbarium-based business card creation helps to recognize examples of Latin names. | 26 | 7 |
| 2 | Making herbarium-based name cards used as group members' names helps students remember their identity and group members. | 26 | 7 |
| 3 | Making herbarium-based business cards trains independence. | 29 | 4 |
| 4 | Making herbarium-based name cards increases the spirit of sharing between group members. | 23 | 10 |
| 5 | Making herbarium-based business cards strengthens concern among group members. | 21 | 12 |
| 6 | Making herbarium-based business cards makes the relationship between members of the group closer. | 19 | 14 |
| 7 | Making herbarium-based business cards strengthens collaboration among group members. | 15 | 17 |

In order to further strengthen the research findings, the researchers administered questionnaires to the students. These questionnaires aimed to assess the students' reflections on their independent learning experiences. The results of the questionnaire data are presented in Table 6.

From the data, it is evident that 79% of students felt that the creation of herbarium-based name cards helped them recognize the authentic Latin names of plants, making it easier for them to remember the plants' identities and their group members. In terms of independence, 88% of students stated that the process of making herbarium-based name cards fostered their independence. Students reported engaging in activities such as selecting plant leaves, drying them, affixing Latin names, and laminating them independently. They also mentioned that during the weeks-long learning process, they were required to keep their name cards private.

Furthermore, although statements 4-7 highlighted the value of collaboration, the data did not reveal any percentage higher than 80%. This suggests the need for further evaluation and the consideration of additional activities within this learning model to maximize both SLI and collaboration simultaneously.

The overall experimental results indicate a significant increase in SLI through the implementation of the PjBL model. The findings demonstrate that the treatment using the PjBL model positively influences and enhances SLI among students (Kopzhassarova et al., 2016); (Aliftika et al., 2021); (Nahdliyati et al., 2016). PjBL empowers students to independently innovate and complete their projects (Martiani, 2021). Implementing this approach has the potential to enhance SLI, fostering a greater sense of autonomy and self-directed learning.

## Conclusion

In conclusion, the findings of this study demonstrate that the project of making herbarium cards in science learning effectively promotes students' independence. The analysis results, using the T-Paired Test, revealed significant differences in student learning independence (SLI) between the pretest and posttest phases. The obtained significance value of 0.001, with a sig value (2-tailed) < 0.05, confirms this significant difference in SLI. Moving forward, it is recommended that future research explores the integration of additional activities within the project-based learning (PjBL) model to enhance teamwork and collaboration among students while maintaining their independence in project completion.

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