Primary: Jurnal Pendidikan Guru Sekolah Dasar
journal homepage: https://primary.ejournal.unri.ac.id/
contents lists available at SINTA and DOAJ

Vol. 13 No. 5 (2024): October
http://dx.doi.org/10.33578/jpfkip-v13i5.p184-190

Project-based learning: Cultivating collaborative skills in science education

Mitha Dwi Anggriani[1*], Ilfi Intansari[2], Lina Indriani[3]

[1] Universitas Riau, Pekanbaru, Indonesia
[2] Universitas Muhammadiyah A.R. Fachruddin, Tangerang, Indonesia
[3] Universitas Samudra, Langsa, Indonesia

Article info

Keywords:
project-based learning, pjbl, science, education

Abstract

This study aimed to evaluate (1) the effect of the Project-Based Learning (PjBL) method on the cooperation skills of elementary school students and (2) the significant difference in cooperation skills between students who followed PjBL and those who followed expository learning. Using a quasi-experimental design with a non-equivalent control group of fifth-grade students, this study divided the sample into two groups: the experimental group using PjBL and the control group applying the expository method. The measurement of cooperation skills was done through observation sheets, with normality and homogeneity tests to ensure the suitability of the data. Data analysis used a paired sample t-test to compare changes in cooperation skills in the same group before and after treatment, and an independent sample t-test was used to compare cooperation skills between experimental and control groups. The results showed that PjBL significantly improved students' cooperation skills compared to the expository method, with a significance value of 0.000 for both tests, which confirmed the effectiveness of PjBL in improving students' cooperation skills compared to the expository method.

* Corresponding Author.
E-mail address: mitha.dwi@lecturer.unri.ac.id (Mitha Dwi Anggraini)
DOI: http://dx.doi.org/10.33578/jpfkip-v13i5.p184-190
Received July 10, 2024; Received in revised form August 8, 2024; Accepted September 29, 2024.
Available online October 10, 2024
[e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

1. Introduction

Primary schools have a crucial role in ensuring educational success, where the teaching and learning process is key to achieving learning objectives. Marissa (2022) asserts that learning is an active process, which aligns with the constructivist approach to learning. Natural Science (IPA) plays a significant role in the education curriculum in Indonesia from elementary school to University. At the elementary level, science learning brings natural concepts studied systematically, emphasizes positive collaboration and social skills, and builds high motivation in students (Simamora et al., 2017). Furthermore, Indarwati et al (2021); and Sulthon (2016) highlighted that science learning involves active experimentation, observation, and reflection, which aims to foster creativity and scientific attitudes in students, not just memorizing information. Science learning in primary schools emphasizes students' learning process and its impact on their development. In this context, the objectives of science learning in primary school become the foundation for ensuring the effectiveness

of such learning. Science learning in elementary school aims to develop scientific skills, understand science concepts, and form attitudes based on learning values. According to BSNP (Kumala, 2016), the goal is to apply scientific knowledge in everyday life and increase environmental awareness and skills to investigate the surrounding nature. Various factors influence the success of learning.

This study found that science learning in some primary schools tends to use expository methods rather than learning strategies that involve students actively, such as Project Based Learning (PjBL). This is not in line with the approach expected by the 2013 curriculum, which emphasizes inquiry, discovery, and project-based learning. In addition, many teachers also still have difficulties in carrying out learning according to the stages set, which has an impact on student involvement in the learning process (Buchari, 2018) which states that many teachers tend to be less able to organize the learning process according to the stages set, for example, a student is only prepared as a child who must want to listen so that in turn makes students unable to activate their abilities.

Based on interviews with fifth-grade teachers in several elementary schools in Pekanbaru, there are several problems in the student learning process. Teachers rarely direct students in group formation, so when groups are formed, students do not help each other and prefer to work on tasks individually. Lack of responsibility is seen when students are not serious about group tasks, and lack of communication results in limited ideas or opinions. Students also tend to choose friends in group formation, preferring to be with their close friends. This is reinforced by Muslim Setyaningsih's (2019) research, which shows the low level of cooperation and interaction between students in this country.

A more in-depth learning approach is needed to address these challenges, allowing students to memorize information and provide a memorable and satisfying experience. One approach that can be used is Project Based Learning (PjBL), which provides opportunities for students to be actively involved in learning. Project Based Learning (PjBL) was chosen because it allows students to work autonomously, face realistic situations, and produce concrete products. This is supported by the results of research conducted by Alamsyah et al. (2021), who used project-based learning, showing differences in the improvement of learning outcomes for students who studied with project-based learning and conventional learning. The project strategy in question is that students are given activities to learn to achieve attitude, knowledge, and skills competencies (Harahap & Mukhaiyar, 2020). The hallmark of project-based learning is project-centered. During problem-solving, students refine questions, debate ideas, make predictions, collect and analyze data, draw conclusions, and communicate findings with their group (Utami et al., 2019). In its implementation, Project Based Learning (PjBL) always pays attention to student activeness (Dharmayani, 2021). Through project-based learning will also provide opportunities for students to explore content (material) and conduct experiments collaboratively to produce a product, the results of which will then be displayed or presented (Prabowo et al., 2020) to develop critical thinking skills and teamwork (Kuppuswamy & Mhakure, 2020). This is supported by the opinion of Saenab et al. (2019), who argued that project-based Learning (PjBL) has stages that can encourage students to develop good cooperation skills in heterogeneous groups. Departing from the above problems, it is necessary to research the effect of Project Based Learning (PjBL) on students' cooperation skills in learning Natural Sciences (IPA) at the elementary school level.

2. Method

This research is a quasi-experimental research with a non-equivalent control group design. The sample amounted to 94 students who were selected using the purposive cluster random sampling technique. This technique is done by deliberately selecting a group of students based on specific criteria and then dividing them randomly into two groups.

The sample was divided into two main groups, namely the experimental group and the control group. The experimental group of 48 students applied the Project Based Learning (PjBL) method. This method involves students in authentic projects related to science subject matter to improve students'

 [e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

cooperation skills. The control group of 46 students used the expository learning method, a traditional learning method that focuses more on delivering material directly by the teacher.

The instrument used to measure students' cooperation skills was an observation sheet designed to assess various aspects of cooperation skills. Before analyzing the data, prerequisite tests were conducted to ensure that the data met the assumptions required for statistical analysis. These prerequisite tests included a normality test to check the distribution of the data and a homogeneity test to ensure equal variance between the groups being compared.

Data analysis was conducted using a paired sample t-test to compare changes in cooperation skills within the same group before and after treatment and an independent sample t-test to compare differences in cooperation skills between experimental and control groups. The paired sample t-test was used to evaluate the differences in cooperation skills in the experimental and control groups over time, while the independent sample t-test was used to compare cooperation skills between two different groups simultaneously.

3. Results

3.1 Sample normality testing

At this stage, testing is carried out with the null hypothesis, stating that the sample has a normal distribution. Acceptance or rejection of this null hypothesis depends on the significance value (sig), where a sig value of less than 5% indicates that the data does not have a normal distribution, while a sig value greater than 5% indicates that the data is usually distributed.

Based on normality testing using Lilliefors Significance Correction of K-S testing, data on student cooperation skills calculated with the help of the SPSS Statistics release 24 computer applications in learning activities using Project Based Learning (PjBL) and expository learning are described in **Table 1**.

Table 1. Normality test of student cooperation skills data taught by project-based learning (pjbl) and expository learning

Data	Sig	Description
Pretest Experiment	0.095	p>0.05 = normal
Post-test Experiment	0.200	p>0.05 = normal
Pretest Control	0.200	p>0.05 = normal
Post-test Control	0.097	p>0.05 = normal

Based on the Kolmogorov Smirnov normality test results on student cooperation skills data in the experimental group using Project Based Learning (PjBL) and the control group using expository learning, the distribution is normal because p> 0.05.

Table 2. Homogeneity test of data on cooperation skills of students taught project-based learning (pjbl) and expository learning

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Cooperation Skills	*Based on Mean*	2.795	1	92	.098
	Based on Median	2.534	1	92	.115
	Based on the Median and with adjusted df	2.534	1	87.799	.115
	Based on trimmed mean	2.775	1	92	.099

3.2 Sample homogeneity testing

This test in the study was carried out on the data of cooperation skills for groups of students who were given treatment using Project Based Learning (PjBL) and expository learning. This test uses Levene's test with the provisions of the sig level—5%. The criterion for determining the homogeneity of the sample variance can be obtained by obtaining the sig. Count the result at the sig level—5%. If the calculated sig value exceeds 5%, it can be concluded that Ho is accepted, then the sample variance is

 [e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

homogeneous. The homogeneity test on student cooperation skills can be seen in **Table 2**. Based on the table above, it is known that the significance value (Sig) Based on Mean cooperation skills is 0.098> 0.05, so it can be concluded that the variance of the experimental class post-test group and the control class post-test is the same or homogeneous.

3.3 Research hypothesis test results

3.3.1 The effect of project-based learning (PjBL) on students' cooperation skills in science learning class V elementary school

The hypothesis test was conducted to analyze the data from observing students' cooperation skills by following Project Based Learning (PjBL). After carrying out calculations on the t-test analysis technique with a 5% significance level using the SPSS statistical release 24 application, the results obtained will be described in **Table 3.**

Table 3. Test results of the effect of using project-based learning (PjBL) on student cooperation skills

Paired Samples Test									
		Paired Differences					t	df	*Sig. (2-tailed)*
		Mean	*Std. Deviation*	*Std. Error Mean*	*95% Confidence Interval of the Difference*				
					Lower	*Upper*			
Pair 1	Pretest - Posttest	-20.85417	6.80735	.98256	-22.83081	-18.87752	-21.224	47	.000

Based on the results of the data calculation on the observation of students' cooperation skills obtained through t-testing (paired test) with a significance level of 5%, that t count is -21.224 with a significance level of 0.000. The calculation results show a t count of -21.224 with a significance level of 0.000 < 5%. So, it can be concluded that project-based Learning (PjBL) in learning science significantly affects student cooperation skills.

3.3.2 The difference in cooperation skills between students who follow project-based learning (PjBL) and students who follow expository learning in science learning in class V elementary school

The results of calculating the observation data of students' group cooperation skills whose teaching is taught using Project Learning (PjBL) and expository learning with the help of the computer program SPSS statistics release 24 it is presented in the following table:

Table 4. Test Results of Differences in Student Cooperation Skills between Student Groups Learning with Project-Based Learning (PjBL) and Expository Learning

Independent Samples Test										
		Levene's Test for Equality of Variances		*t-test for Equality of Means*						
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*95% Confidence Interval of the Difference*	
									Lower	*Upper*
Cooperation Skills	*Equal variances assumed*	2.795	.098	13.498	92	.000	14.44928	1.07051	12.32316	16.57539
	Equal variances are not assumed.			13.429	85.377	.000	14.44928	1.07597	12.31009	16.58846

The results of the data calculation for student cooperation skills obtained a sig level (2-tailed) = 0.000. This shows that the sig level (2-tailed) = 0.000 is below the sig value. Ho is rejected, and Hi is accepted at 5% or (0.000 < 5%). This means there is a significant difference in cooperation skills between groups of students taught using Project Based Learning (PjBL) and expository learning. Based on the acquisition of the average value of the observation of students' cooperation skills, it shows that the average value of learning by using Project Learning (PjBL) is 89.67, where this figure is more than the average use of expository learning of 75.22 regarding this it can be concluded that in general the student cooperation skills achieved by groups of students who learn by using Project Based Learning (PjBL) are better than groups of students who learn by expository learning.

4. Discussion

Based on the results of data analysis obtained through observation of students' cooperation skills, which were then tested using the t-test (paired test) with a significance level of 5%, the t-value obtained was -21.224 with a significance level of 0.000. These results show that the obtained t value (-21.224) as well as the significance value (0.000) are smaller than the established significance limit (0.000 <0.05). In other words, there is strong evidence to reject the null hypothesis (Ho) and accept the alternative hypothesis (Hi), which indicates that the application of Project Based Learning (PjBL) in science learning has a significant effect on improving students' cooperation skills.

This conclusion follows the opinion of Dahlan et al. (2020), who suggest that in project-based Learning, students learn about the subject matter and are trained to interact effectively in groups. They can combine various ideas and energy to solve the problems in the project. This process involves steps of investigation and information gathering, which, in the end, can produce an actual product due to group work. This leads to developing cooperative skills, essential in 21st-century learning that prioritizes collaboration and communication skills.

This opinion is also supported by Indriyana and Susilowati (2020), who explained that project-based learning has great potential to foster cooperative skills among students, especially in heterogeneous groups. The diversity of student backgrounds in this group is an opportunity to enrich the learning process because students can complement each other and share their knowledge and skills. Furthermore, Susilawati (2022) and Rio & Rodriguez (2022) also stated that by using Project Based Learning (PjBL), students are required to work hard and cooperate in groups to complete projects. They learn to support each other and collaborate with other group members, improving their cooperation skills.

Pratiwi and Ardianti (2018) added that one of the essential aspects of project-based learning is the development of communication skills among group members. In this context, students are not only required to speak or discuss but also to be able to listen and understand the ideas of their peers. Effective communication is key to creating solid cooperation, where each group member can contribute optimally to achieve a common goal. Therefore, Project Based Learning effectively improves cooperation and interaction skills in groups.

Furthermore, the results of the data calculation show that the significance value (2-tailed) obtained is 0.000, which is much smaller than the 5% significance level (0.000 < 0.05). This indicates a significant difference between the cooperation skills of students who use Project Based Learning (PjBL) and those who use the expository approach. Based on these results, the null hypothesis (Ho), which states that there is no difference in cooperation skills between the two groups, can be rejected, while the alternative hypothesis (Hi), which states a significant difference, is accepted.

Furthermore, comparing the average value of students' cooperation skills between the two groups shows significant results. The average score of cooperation skills of students who followed learning using Project Based Learning was 89.67, while the group that followed the expository approach obtained an average score of 75.22. This difference illustrates that students who learn through Project Learning have better cooperation skills than students who follow learning using the expository

 [e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

method. This proves that Project Based Learning is more effective in developing students' cooperation skills.

This view is also supported by the research of Saenab et al. (2019), which states that the stages in Project Based Learning strongly support the development of students' cooperation skills, especially in heterogeneous groups. Each stage in the project provides opportunities for students to collaborate, share ideas, and solve problems, encouraging group members' cooperation. Puwerman (2021) also stated that group work in Project Learning directs students to achieve specific goals through directed discussions, where each group member has a clear role and responsibility in achieving the project's final results.

In addition, Tusaddiah's (2021) opinion that learning with an expository approach often invites students to participate in structured discussions but does not always encourage the active involvement of each student in the group work process is also relevant in this context. The expository approach emphasizes the direct delivery of information from teachers to students. In contrast, in Project Based Learning, students are given more space to interact, plan, and implement projects together, which directly encourages the development of their cooperation skills.

5. Conclusion and Implications

The conclusions in this study are 1) there is a significant effect in the use of Project Based Learning (PjBL) in science learning activities on the cooperation skills of grade V elementary school students; 2) there is a significant difference in the group cooperation skills of students who apply Project Based Learning (PjBL) and expository learning. This finding confirms that Project Based Learning (PjBL) is a practical learning approach to shaping students' cooperation skills at the elementary school level. The implication is that integrating PjBL into the curriculum and the need for teacher training to implement this method effectively is very important. Recommendations for future research include further exploration of the factors that influence the effectiveness of PjBL and the application of this method in various learning contexts to support holistic student development.

References

Alamsyah, Alamsyah, Maman Rumanta, and Widiasih Widiasih. 2021. “Pengaruh Model Pembelajaran Project Based Learning Dan Keterampilan Kolaborasi Terhadap Hasil Belajar IPA Siswa.” *Jurnal Elementaria Edukasia* 4(2): 179–88.

Buchari, Agustini. 2018. “Peran Guru Dalam Pengelolaan Pembelajaran.” *Jurnal Ilmiah Iqra’* 12(2): 106–24.

Dahlan, Taufiqulloh, Dadang Iskandar, Deni Harmaen, and Hani Noerafifah. 2020. “Analisis Kerjasama Siswa Sekolah Dasar Melalui Pembelajaran Project Based Learning.” *Didaktik: Jurnal Ilmiah PGSD STKIP Subang* 6(2): 234–43.

Dharmayani, Ni Ketut Yuliana. 2021. “Penerapan Model Pembelajaran Project Based Learning (PjBL) Untuk Meningkatkan Keaktifan Dan Hasil Belajar Siswa Pada Kompetensi Dasar Membuat Jamu Dan Boreh/Lulur Perawatan Badan.” *Journal of Education Action Research* 5(2): 216–21.

Harahap, Tania Octavia, and Riki Mukhaiyar. 2020. “Meta Analisis Efektivitas Model Pembelajaran Project-Based Learning.” *Jtev* 06(02): 433–41.

Indarwati, Dwi, Faridl Musyadad, and Wahyu Murti Utami. 2021. “Urgensi Media Pembelajaran Audio Visual Pada Hasil Belajar Ilmu Pengetahuan Alam (IPA) Di Sekolah Dasar.” *Dikdastika: Jurnal Ilmiah Pendidikan ke-SDan* 7(1): 23–30.

Indriyana, Riyani Septi, and Susilowati Susilowati. 2020. "The Effects of Model Project-Based Learning Approach on STEM (Science, Technology, Engineering, Mathematics) on Natural Science Learning to Junior High School Student's Critical Thinking Skills And Cooperative Skills at SMP N 1 Berbah." *Journal of Science Education Research* 4(2): 70–75.

Kumala, Farida Nur. 2016. 8 *Pembelajaran IPA Sekolah Dasar*. Ediide Inf. Malang.

 [e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

Kuppuswamy, Ramesh, and Duncan Mhakure. 2020. "Project-Based Learning in an Engineering-Design Course - Developing Mechanical- Engineering Graduates for the World of Work." *Procedia CIRP* 91: 565–70. https://doi.org/10.1016/j.procir.2020.02.215.

Marissa, Novaria. 2022. "Pengaruh Sikap Belajar Siswa Terhadap Prestasi Belajar Geografi Siswa." *Meretas : Jurnal Ilmu Pendidikan* 9(1): 32–45.

Muslim, Aji Heru, and Nikmah Setyaningsih. 2019. "Peningkatan Sikap Kerjasama Dan Prestasi Belajar Siswa Melalui Pembelajaran Sosiodrama Berbasis 'Atong' Pada Tema 8 Di Kelas IV SD N 1 Limpakuwus." *Jurnal Riset Pendidikan Dasar* 02(2): 122–29. http://journal.unismuh.ac.id/index.php/jrpd.

Prabowo, Didi, Henry Januar Saputra, and Filia Prima Atharina. 2020. "Pengaruh Model Pembelajaran Project Based Learning Terhadap Hasil Belajar Siswa Kelas V Sd Sawah Besar 01." *Elementary School* 1(1): 16–25.

Puwerman. 2021. "Upaya Peningkatan Kompetensi Belajar Bahasa Indonesia Melalui Metode Diskusi Kelompok Menggunakan Point System Bagi Siswa Kelas X SMAN 16 Tebo." *Secondary: Jurnal Inovasi Pendidikan Menengah* 1(4): 329–35.

Rio, T Gomez-del, and J. Rodriguez. 2022. "Design and Assessment of a Project-Based Learning in a Laboratory for Integrating Knowledge and Improving Engineering Design Skills." *Education for Chemical Engineers* 40: 17–28. https://doi.org/10.1016/j.ece.2022.04.002.

Saenab, Sitti, Sitti Rahma Yunus, and Husain Husain. 2019. "Pengaruh Penggunaan Model Project Based Learning Terhadap Keterampilan Kolaborasi Mahasiswa Pendidikan IPA." *Biosel: Biology Science and Education* 8(1): 29–41.

Simamora, Delima Meilyana, Tri Jalmo, and Berti Yolida. 2017. "Profil Kemampuan Kerjasama Siswa Dalam Pembelajaran IPA." *Biortedidik, Wahana Ekspresi Ilmiah* 5(2).

Sulthon, Sulthon. 2016. "Pembelajaran IPA Yang Efektif Dan Menyenangkan Bagi Siswa MI." *ELEMENTARY: Islamic Teacher Journal* 4(1): 38–54.

Tusaddiah, Nurhalimah. 2021. "Pengaruh Strategi Pembelajaran Ekspositori Terhadap Hasil Belajar Ekonomi Pada Materi Masalah Pokok Ekonomi Di Kelas X SMA Negeri 5 Padangsidimpuan." *Jurnal Misi Institut Pendidikan Tapanuli Selatan (IPTS)* 4(1): 9–14.

Utami, Zaskya Laksmita, Nurdin Bukit, Mariati P Simanjuntak, and Motlan. 2019. "Pengaruh Model Project Based Learning Terhadap Keterampilan Berpikir Kreatif Pada Materi Fluida Dinamis Di Sma." *Jurnal Pendidikan Fisika* 8(2): 97–101

 [e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]