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Growing Elementary School Students' Collaboration Skills through the Project-Based Learning Model

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Abstract: This study seeks to examine the effect of the Project-Based Learning Model (PJBL) model on enhancing the collaboration skills of 3rd-grade students at Madrasah Ibtidaiyah Ma'arif Nahdlatul Ulama Sungegeneng, particularly in Arts and Culture subjects. It employed a quantitative pre-experimental approach using a one-group pretest-posttest design. Data were collected through collaboration questionnaires, teaching modules, interviews, observations, and documentation. The participants consisted of 34 3rd-grade students of Madrasah Ibtidaiyah Ma'arif Nahdlatul Ulama Sungegeneng. The findings revealed that the mean pre-test score was 47.29, while the mean post-test score increased to 78.85, indicating a gain of 31.56 in collaboration skills. The results of the hypothesis testing showed a p-value of 0.000, suggesting that Ha was accepted. Therefore, it can be concluded that the implementation of the PJBL model has a significant effect on students' collaboration skills in 3rd-grade Arts and Culture subjects at Madrasah Ibtidaiyah Ma'arif Nahdlatul Ulama Sungegeneng. The implications of this study indicate that the PjBL model can serve as an effective alternative instructional strategy for enhancing elementary school students' collaboration skills, particularly in Arts and Culture subject.
Keywords: Collaboration skill, elementary school, project-based learning model

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A. Introduction

The Industrial Revolution 4.0 is commonly identified as the era of "21st-century learning." Within the educational sphere, this period introduces substantial challenges in preparing younger generations, particularly in terms of developing the 4C competencies: critical thinking, collaboration, communication, and creativity (Parawansa & Fadilah, 2023). This educational approach aims to equip learners with the essential skills required to address 21st-century demands, including critical thinking, effective communication, collaboration, and creativity. Such competencies empower students to navigate complex problems, adjust to ongoing changes, and participate actively in a continually evolving society (Rosnaeni, 2021).

The Independent Learning Curriculum emerges as a response to the demands of global competition in the 21st century (Indarta et al., 2022). Introduced as a recent policy by the Ministry of Education, Culture, Research, and Technology of the Republic of

Indonesia (Kemendikbud Ristek RI), this curriculum is intended to promote innovative learning that prioritizes students' 21st-century needs. One of its central features is the adoption of project-based learning, aimed at enhancing students' soft skills and character in alignment with the Pancasila student profile. Furthermore, teachers are afforded flexibility in selecting appropriate strategies, models, media, and instructional materials, enabling them to adapt teaching to students' interests and learning needs through a differentiated approach in response to the evolving demands of the modern era. Among the essential competencies required to meet 21st-century challenges is collaboration, which refers to a collective effort involving two or more individuals working toward a shared objective. It underscores mutual benefit, with each participant assuming clearly defined roles and responsibilities within the group (Widodo & Wardani, 2020).

Collaborative skills are behaviors that enable individuals to work effectively with others and function well in groups. This process involves willingness to participate, commitment to teamwork, ability to listen to others, and encouragement from peers to share ideas and opinions. In the context of education, these skills should be integrated into learning activities both in and out of the classroom. Collaboration can help achieve learning objectives more efficiently, as working within a learning community often leads to better outcomes than working individually (Irnaningsih et al., 2021). Collaborative learning is crucial in elementary education because it improves students' social, communication, and empathy skills, and is effective in increasing cognitive learning outcomes and student engagement through group discussions. This method encourages student activity, responsibility, and builds self-confidence (Laela et al., 2024)

Based on observations conducted in Grade 3 at Madrasah Ibtidaiyah Ma'arif Nahdlatul Ulama Sungegeneng Lamongan to assess students' collaboration skills, researchers used a collaboration questionnaire to identify their initial abilities. The pre-research findings showed that out of 34 students, 5.88% (2 students) were categorized as highly collaborative, 41.17% (14 students) as moderately collaborative, and 52.94% (18 students) as having low collaboration skills. These results indicate that the overall level of students' collaboration at Madrasah Ibtidaiyah Ma'arif Nahdlatul Ulama Sungegeneng remains relatively low, with the majority falling into the less collaborative category (52.94%). This condition affects students' ability to work effectively with others. The monotonous learning process and the use of conventional, teacher-centered teaching methods influence the low level of collaboration. Therefore, to enhance students' collaboration skills, teachers need to implement collaborative learning models that actively engage students in the learning process.

Collaborative learning is an instructional approach in which students work in groups to construct knowledge and achieve shared learning objectives through interaction and cooperation (Muthmainnah et al., 2023). Collaborative learning involves organizing students into small groups where they interact and cooperate within the learning process. This model allows for more intense interaction, where students can freely seek information and discuss with their group members (Sekarwati, 2023) . As an educator, a teacher must carefully prepare everything for learning activities, including the learning

implementation plan, learning media, evaluation questions, learning models, learning strategies, and learning methods to be used. All of these learning tools must, of course, be integrated with 21st-century learning. This research not only applies a collaborative learning model but also develops integrated learning tools (lesson plans, media, evaluation instruments, and strategies) explicitly designed to address 21st-century skills. Collaborative learning in this study emphasizes students' freedom to explore information and construct knowledge independently through structured group discussions.

A highly effective learning model to support these activities is the PjBL model. PjBL is a student-centered approach in which learners engage in projects over a specific period to produce a tangible outcome. These projects can be completed individually or in groups, allowing students to actively collaborate, gain knowledge, and develop practical, real-world experience through the learning process (Rahayu et al., 2019). The PjBL method requires students to take an active role in the learning process and collaborate within their groups to complete project tasks assigned by the teacher. As a result, implementing this model can effectively enhance students' collaboration skills. In PjBL, the success of a project depends on each group member's contributions, encouraging students to support one another, exchange ideas, and work synergistically. Additionally, students are often assigned specific roles—such as researcher, note-taker, or presenter—which helps build individual responsibility within a team setting, a key aspect of effective collaboration.

PjBL is an instructional approach centered on learning through projects to produce products that address problems in everyday life. PJBL centers on students solving their own problems (Fahrurrozi & Mohzana, 2020). Project-based learning has several advantages, namely increasing students' motivation to learn, enhancing students' problem-solving skills, and fostering students' cooperation in group work (Pramiswari et al., 2023).

Project-Based Learning has several key characteristics: (a) students are involved in making decisions regarding the learning framework; (b) learning begins with problems or challenges presented to students; (c) students plan and design processes to find solutions to these challenges; (d) they take collective responsibility for accessing and managing information needed to solve problems; (e) assessment is conducted continuously throughout the process; (f) students regularly reflect on the activities they have completed; (g) the final product is evaluated using measurable criteria; and (h) the learning environment is flexible and open to mistakes and changes (Khanifah, 2019). PjBL can encourage students to actively demonstrate skills, knowledge, and attitudes in various contexts to complete the projects/activities they are working on. Provide opportunities for students to practice their cooperative and collaborative skills in a team. As a result, students will be more active and braver in expressing their opinions in groups formed with friends.

The selection of the PjBL model effectively enhances students' learning outcomes and collaboration skills, as research by Efriyana Marpaung shows that students' collaboration, creativity, and communication skills improve when the Project-Based

Learning model is applied in social studies (Efriyana et al., 2023). Further research conducted by Siti Humaeroh and colleagues indicates that implementing the PjBL model can enhance elementary school students' collaboration skills (Humaeroh et al., 2023) . Then, research conducted by Indarwati et al. (2022) showed that there was an increase in students' collaboration skills regarding the use of the PjBL model in psychotropic material at the high school level.

A research gap persists, as most previous studies have focused on implementing the PjBL model in specific grade levels and subjects, with limited attention to its use in Arts and Culture subjects at lower grades in Islamic elementary schools. The novelty of this study lies in applying the PjBL model in grade 3 of Madrasah Ibtidaiyah, emphasizing students' collaboration skills and employing a pre-experimental quantitative approach within the context of Arts and Culture learning. This study aims to examine the effect of the PjBL model on improving students' collaboration skills and to measure the extent of this improvement after the learning process is implemented.

B. Method

This research uses a quantitative approach with a one-group pretest-posttest design. The research design includes one group that is observed at the pre-test stage, followed by treatment and post-test (Creswell, 2017) . This research aims to determine the influence of using the PJBL model on students' collaboration skills in the grade 3 art, culture, and crafts subject at Madrasah Ibtidaiyah Ma'arif Nahdlatul Ulama Sungegeneng, Lamongan Regency. The subjects of this research were class 3 at Madrasah Ibtidaiyah Ma'arif Nahdlatul Ulama Sungegeneng, comprising 34 students: 16 female and 18 male.

The data in this study were collected using questionnaires, interviews, observation, and documentation. The validity of the teaching module in this research was assessed by an expert validator, with a validity level of 88%, indicating that it can be used without revision for research (Rifanah, 2023). The validity of the teaching module in this research was assessed by an expert validator, with a validity level of 88%, indicating that it can be used without revision for research (Rifanah, 2023). The instrument was then tested on non-respondent students. Collaborative skills are measured through indicators of active participation, individual responsibility, effective communication, cooperation, and the ability to make decisions and resolve conflicts within a group (Rifanah, 2023). The instruments used are conceptually structured as Likert-scale questionnaires, 1-4 observation sheets, or assessment rubrics to capture students' collaborative behaviour. This instrument is designed to be valid and reliable, accurately describing students' collaborative skills during the learning process. The instrument is considered valid if the significance value is < 0.05.

After all the research data was collected, data analysis was carried out using scoring techniques (Kurniawan, 2021), achievement of collaboration skills (Sufajar & Qosyim, 2022), mean analysis (Zafri & Hastuti, 2023), and N-Gain analysis (Prafitasari, 2023), which is used to analyze students' collaboration skills. After that, a normality test was performed using SPSS version 26. By determining whether the p-value in the normality

test was > 0.05, it could be concluded that the research data followed a normal distribution (Rahmadani et al., 2023). Next, a hypothesis test was carried out. If the data are normally distributed, the paired t-test is used, with the decision based on the significance value as follows: if < 0.05, then H0 is rejected and Ha is accepted. If > 0.05, then H0 is accepted, Ha rejected. However, if the data are not normally distributed, the hypothesis test uses the Wilcoxon test, with the decision based on whether the value is asymp. Sig. (2-tailed) < 0.05, the difference is significant. Conversely, if the value of asymp. Sig. (2-tailed) > 0.05, it can be considered that there is no significant difference (Trijayanti et al., 2022).

C. Result and Discussion

Result

This research was conducted over six meetings. In the first meeting, the researcher administered a pre-test to students to measure their initial collaboration skills before implementing the PjBL model. Subsequently, in the second through fifth meetings, the PjBL model was implemented in the learning process. In the sixth meeting, the researcher administered a post-test to evaluate students' collaboration skills after participating in the PjBL learning model.

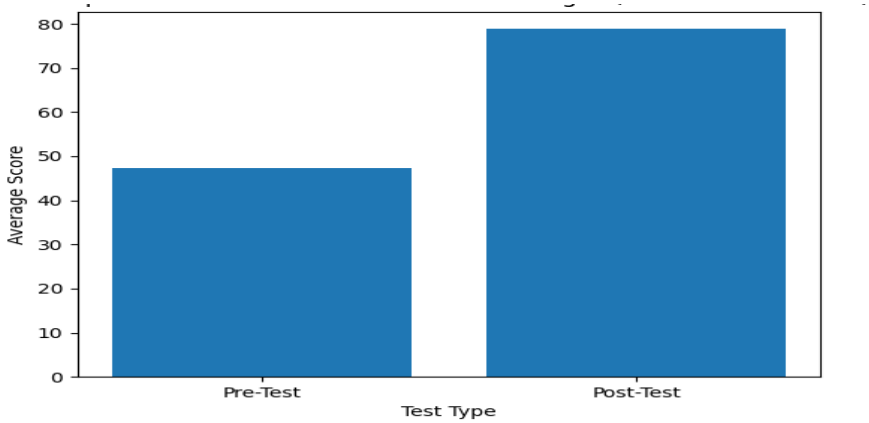

Figure 1. Comparison of Pre-test and post-test averages (Collaboration skills)

Collaboration Skills Analysis Results

Data on the pre-test and post-test results of SBdP learning using the PJBL model (Figure 1) show that 8 students were less collaborative, 25 were quite collaborative, and 1 was collaborative. Meanwhile, the post-test results showed that 3 students were quite collaborative, 12 students were collaborative, and 19 students were very collaborative. The average pre-test result was 47.29, and the average post-test result was 78.85. The data show an increase of 31.56 in the average results for student collaboration skills. Then, an N-Gain analysis of the average pre-test and post-test scores was conducted. The N-Gain was 0.58, indicating an increase in student learning outcomes during the learning process in the medium category.

Normality test

The basis for decision-making in carrying out a normality test is that if the value in the normality test is > 0.05, it can be stated that all research data follows a normal distribution pattern. The results of the normality test can be seen in the table below:

Table 1. Normality Test Results

	Kolmogorov-Smirnov [a]		**Shapiro-Wilk**		
	Statistics	**df**	**Statistics**	**df**	Sig.
Pre Test	.089	34	.946	34	.092
Post Test	.144	34	.942	34	.069
*. This is a lower bound of the true significance.					
a. Lilliefors Significance Correction					

Based on Table 1 the normality test results presented in the table, the p-value obtained from the Kolmogorov–Smirnov test was 0.200 for the pre-test data and 0.72 for the post-test data. These values exceed the significance threshold of 0.05, indicating that both datasets are normally distributed. Consequently, as the assumption of normality is satisfied, the hypothesis testing procedure can proceed using parametric tests.

Hypothesis testing

The effect of implementing the PJBL model on students' collaboration skills was analyzed using a paired-samples T-test. The results of the hypothesis test are as follows:

Table 2. Hypothesis Test Results Paired Sample T-test

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	Pre_test - Post_test	-31.559	13.839	2.373	-36.388	-26.730	13.297	33	.000

Based on the table 2, the results of the Paired Sample t-test conducted using SPSS version 26 show a significant Asymp. (2-tailed) value of 0.000, which is below the 0.05 significance level. This indicates that Ha is accepted and H0 is rejected, confirming a significant effect of the PJBL model on students' collaboration skills in grade 3 SBdP subjects at Madrasah Ibtidaiyah Ma'arif Nahdlatul Ulama Sungegeneng. From a theoretical perspective, these findings suggest that the implementation of PjBL can enhance collaboration skills, as the learning process is centered on group-based activities that necessitate intensive social interaction. From a social constructivist perspective, students build knowledge through collaboration, discussion, and the exchange of ideas during the project completion process. PjBL also encourages individual responsibility within the group so that each student contributes to the collective success. In addition, the project's contextual and challenging characteristics facilitate communication,

coordination, and collective decision-making. Conceptually, PjBL aligns with the development of collaboration skills as part of 21st-century competencies.

Discussion

The study's findings show that implementing the PjBL model significantly enhanced students' collaboration skills. This improvement is reflected in the pre-test and post-test results, which show an average gain of 31.56 and an N-Gain score of 0.58, both of which are categorized as moderate. These results suggest that PjBL is effective in promoting active student participation in the learning process. The findings are consistent with previous research by Lubis et al. (2024), which found that PjBL can improve collaboration skills through project-based activities that require active student interaction. It is also supported by research by Sari & Richmiyati (2023), which shows that project-based learning can improve collaboration and group decision-making skills.

Based on the syntactic analysis of PjBL collaboration skill indicators, in the first step, namely determining basic questions, students begin to demonstrate the ability to express ideas and reach consensus through group discussions. This activity is closely related to collaboration indicators, namely the ability to communicate and participate actively in groups. At this stage, students not only express their opinions but also learn to respect others' perspectives and build shared understanding (Lubis et al., 2024; Mona Rachmawati, 2023).

Furthermore, during the project planning stage, students demonstrated improvements in their ability to collaborate and make shared decisions. During this process, students discussed, sought information from various sources, and considered various alternative solutions before making a group decision. These activities trained students to accept criticism and suggestions and to develop a compromise attitude in collaborative problem-solving (Sari & Richmiyati, 2023; Putri Cahya et al., 2023).

During the project schedule development stage, indicators of collaboration included the ability to manage time and to share responsibilities. Discussions during schedule development encouraged students to respect one another's opinions, negotiate, and agree on a fair division of tasks. It strengthened students' teamwork skills and fostered a sense of collective responsibility for the project's success (Putri Cahya et al., 2023; Mona & Rachmawati, 2023).

The project implementation and monitoring stages demonstrated improvements in indicators of productive work and shared responsibility. Students actively engaged in product creation, assisted one another, and ensured that each group member contributed. Students actively engaged in product creation, assisted one another, and ensured that each group member contributed. This process emphasizes the importance of effective collaboration and efficient time use, so that success is measured not only by the final result but also by the collaborative process itself (Lubis et al., 2024; Sari & Richmiyati, 2023).

During the project presentation stage, indicators of collaboration that emerge are communication skills and active contributions within the group. Students work together to communicate project results communicatively, share roles during presentations, and

respond to questions from other groups. This activity strengthens students' self-confidence while improving their social interaction skills in an academic context (Lubis et al., 2024; Mona & Rachmawati, 2023).

Finally, during the evaluation phase of the learning experience, students demonstrate their ability to reflect collectively and provide feedback to one another. This activity encourages students to evaluate the group work process, identify strengths and weaknesses, and refine future collaboration strategies. Thus, the entire PjBL syntax systematically improves students' collaboration skills, including communication, cooperation, responsibility, and decision-making (Mona & Rachmawati, 2023; Putri Cahya et al., 2023) .

The findings of this study are consistent with previous research, indicating that implementing PjBL significantly enhances students' collaboration skills. These similarities lie in improvements in social interaction, group cooperation, and individual responsibility in completing collaborative tasks. However, there are differences in the research context, particularly at the elementary school level, in Arts and Culture subjects, and in student characteristics at Madrasah Ibtidaiyah Ma'arif Nahdlatul Ulama Sungegeneng. These differences can also be seen in the learning design, media used, and the level of complexity of the projects given to students. Furthermore, the learning environment and school culture also influence the dynamics of collaboration formed within groups. Another factor that may influence the results is the teacher's role in facilitating discussions and managing group work effectively. Students' learning motivation and readiness to collaborate are also important factors supporting the success of PjBL implementation. Thus, although the results show a similar trend, variations in context and supporting factors can have varying degrees of influence on students' collaboration skills.

Based on the analysis of the implementation of the PJBL model above, it can be concluded that the PJBL model improves students' collaboration skills. PjBL is characterised by activities that emphasise student group work. It allows students to develop the conceptual knowledge needed to complete the projects they work on. One advantage of the PJBL model is that it can improve collaboration skills. These collaboration skills naturally develop during the learning process, from the project plan design stage through preparing the project completion schedule, implementation, and monitoring, to the results testing stage (Alfiyyana, 2022).

The findings of this research strengthen the work of Elok Dara Pramiswari et al., which shows that using a project-based learning model influences students' collaboration skills in Mathematics. It is because the implementation process requires students to collaborate from the initial stage, namely preparing tools and materials, to the final stage, namely presenting the product that has been made (Pramiswari et al., 2023). The implications of this research suggest that teachers should systematically design PjBL by establishing clear collaborative objectives and developing projects that require student cooperation. Teachers are advised to form heterogeneous groups and assign roles so that each student has responsibility in the learning process. Furthermore, teachers need to

facilitate interaction through guidance, prompting questions, and monitoring during group discussions. The use of assessment instruments, such as collaboration rubrics, is also crucial for objectively evaluating the process and outcomes of group work. With planned and directed implementation, PjBL can effectively improve students' collaborative learning skills (Pramusinta & Lestari, 2025).

D. Conclusion

Based on the analysis, the PjBL model is effective in enhancing students' collaboration skills. Each step of the PjBL syntax provides opportunities for students to work together, exchange ideas, make joint decisions, and share responsibilities. Through activities such as project planning, scheduling, implementation, monitoring, and presentation, students develop essential collaborative competencies, including communication, compromise, respect for others' opinions, and collective problem-solving. The findings also affirm that the PjBL model not only emphasizes the final product but, more importantly, the collaborative process throughout the project. This process trains students to contribute actively, accept feedback, and support one another in achieving shared goals. The results of this study are consistent with previous research, which also highlights that the PjBL model significantly influences students' collaboration skills in various subjects. Therefore, the PjBL model can be considered an effective pedagogical approach to fostering teamwork and preparing students with essential 21st-century collaboration skills.

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