

Impact of Multidisciplinary Project Based Learning on Teacher Collaboration Skill

Epong Utami^{1*}, K Khaerudin², Murni Winarsih³
Universitas Negeri Jakarta, Jakarta, Indonesia
*epongutami_9901821021@mhs.unj.ac.id

Abstract. The digital era requires students to be able to improve their 21st century abilities. One approach that can be used is project-based learning. This ability improvement must also be supported by all teachers so that there is a need for teacher collaboration in carrying out project-based learning. This form of collaboration can be done by integrating each subject in accordance with the project theme to not only provide knowledge but also the mentoring process from the planning stage to the assessment at the project exhibition. To realize this, it is necessary to implement multidisciplinary project-based learning. The purpose of this study is to explore the impact of the application of multidisciplinary project-based learning on improving teachers' collaboration skills. This study uses a qualitative research method with 6 respondents of teachers who teach grades 7 and 8 at the School of Human Junior High School. The data collection used is by observation both before and after the implementation of multidisciplinary project-based learning. The results of the observation are then reflected qualitatively with the indicators of collaboration skills observed following Greenstein's (2012) theory, namely (1) actively participating; (2) work productively; (3) be re-sponsible; (4) flexibility and compromise; (5) mutual respect between group members. The results of this study show that there is an improvement in teachers' collaboration skills after the implementation of multidisciplinary project-based learning. 4 out of 5 indicators are categorized as very good and 1 indicator is categorized as good. Significant changes are found in the attitude of responsibility of each member towards the projects implemented.

Keywords: Project based learning, multidisciplinary project-based learning, Collaboration, Teacher Collaboration.

1 Introduction

In the midst of the ever-evolving demands of education in the digital era, project-based learning (PBL) based learning is increasingly being introduced as a solution to encourage active student engagement, in research conducted by Rehman[1] proves that project-based learning can promote active learning and increase student engagement in addition to developing 21st century skills, such as critical thinking, creativity, and collaboration [2] PBL is not only an approach that focuses on real-world problem-based learning, but it also encourages interaction across disciplines, providing opportunities for students to learn in a broader and more relevant context.

According to mebert [3] projects that are carried out collaboratively and discuss real-world problems can increase student involvement in completing their projects. Although PBL is more often associated with its impact on student learning, the implementation of PBL also brings significant changes in professional dynamics in the world of education, especially in building a culture of collaboration between teachers. Project-based learning with garden-based school activities encourages student collaboration and participation, while offering an enriched sensory experience that benefits the learning and development of all students, this is supported by the integration of teacher collaboration [4].

Based on the results of the research, teacher collaboration can overcome some of the challenges they face as a result of the limited provision of resources in schools in the South African country [5]. In addition to the division of responsibilities in teaching, this is also an effective strategy in the teaching process carried out by teachers [6]. Collaboration between teachers is a key element in creating a dynamic and innovative educational environment. Research shows that effective collaboration between educators can improve the quality of teaching, enrich pedagogical practices, and create a more inclusive and collaborative learning atmosphere for students [6]. On the other hand, the application of multidisciplinary PBL in the classroom requires interaction between teachers from different disciplines, which not only provides a more holistic learning experience for students, but can also strengthen professional collaboration between teachers. In this context, the culture of collaboration built through multidisciplinary PBL is expected to be able to overcome the challenges of cooperation between teachers, which are often constrained by differences in discipline, time, and skills.

The implementation of PBL involving more than one discipline requires teachers to work together in designing and executing projects that integrate various topics and skills [7]. For example, math teachers can work closely with English and natural science teachers on a single project, where their collaborative skills will complement each other. This kind of project not only enhances the learning experience of students, but also enhances teachers' collaborative abilities, enriches their teaching practices, and broadens pedagogical horizons.

However, challenges in implementing multidisciplinary PBL remain, especially related to the provision of time [8], training, and opportunities for teachers to work together effectively [7]. Research shows that while many teachers are aware of the importance of collaboration, they are often faced with structural and organizational cultural constraints that limit their collaboration. Therefore, it is crucial to dig deeper into how multidisciplinary-based PBL can help overcome these barriers and build a stronger culture of collaboration among teachers.

This study aims to explore the impact of the implementation of multidisciplinary Project Based Learning (PBL) in improving the culture of collaboration between teachers in schools. This study will examine how the implementation of PBL can strengthen relationships between teachers, improve collaborative skills, and improve the quality of teaching they provide. Thus, this research is expected to contribute to the development of more collaborative educational policies and practices, especially in the context of learning based on multidisciplinary projects.

2 Method

This type of research is a type of qualitative research with research subjects, namely 6 (six) teachers involved in Multidisciplinary Project Based Learning in grades 7 and 8 at School of Human Junior High School. This number of teachers is related to the theme of the project, namely Agent Of Change on Fast Fashion problems. The goal of this project is to redesign old clothes and clothing accessories with various techniques so that clothes and fashion accessories that are suitable for reuse such as sequin techniques, tie dye, eco print, and embroidery are produced.

The subjects that are connected at each level include in grade 7, science subjects that discuss substances and their characteristics, social studies that discuss SDGs in local, regional, and global contexts, and typical school subjects, namely 21st academic which discusses problem solving about consumptive habits. At the 8th grade level, the connected subjects include social studies discussing awareness of social change, science regarding environmental pollution, especially the problem of textile waste, Indonesian regarding procedural texts that discuss the stages of redesign The re-search was carried out in October-December 2024.

The data collection technique was carried out by observation techniques which were then analyzed qualitatively by reflecting the results of observations of teachers' collaboration skills before and after the implementation of multidisciplinary project-based learning in grades 7 and 8. Indicators of collaboration skills according to Greenstein (2012) are (1) actively participating; (2) work productively; (3) be responsible; (4) flexibility and compromise; (5) mutual respect between group members. The indicators of collaboration skills that have been compiled are listed in table 1.

Table 1. Collaboration Skills

No	Indicator	Information
1	Contribute actively	Contribute to presenting the results of thoughts, uniting the discussion and seeking solutions to problems.
2	Work productively	Actively conducting discussions, completing tasks effectively and efficiently, focusing on discussing in finding solutions and communicating smoothly in discussions.
3	Showing an attitude of responsibility	Responsible for the assigned assignments, completing tasks on time, complying with the instructions given.
4	Showing flexibility and compromise	Accept criticism and suggestions, discuss differences of opinion and accept assignments given.
5	Show mutual respect	Respect and respect the opinions of friends in the forum, do not impose opinions and accept mutual decisions in solving problems.

Source: [9]

Quantitative data was carried out to calculate the results of observation of teacher collaboration skills using percentage correction from before and after the

implementation of multidisciplinary project-based learning with the following equation:

$$\text{Percentage} = \frac{\text{Total Score}}{\text{Maximal Score}} \times 100\%$$

The observation data analysis technique was carried out by calculating the average score before and after the implementation of multidisciplinary project-based learning which was then categorized according to table 2.

Table 2. Criteria for Collaboration Skills

Range	Categories
$80,00 < x \leq 100,0$	Excellent
$60,00 < x \leq 80,00$	Good
$40,00 < x \leq 60,00$	Enough
$20,00 < x \leq 40,00$	Less
$00,00 < x \leq 20,00$	Very Less

Source: [10]

3 Result And Discussion

The results of observations before the implementation of multidisciplinary project based learning were obtained as a result of collaboration skills carried out by the six teachers who taught in grades 7 and 8 of School of Human Junior High School with the following results:

Table 3. Percentage of Collaboration Skills Before Multidisciplinary Project Based Learning

No	Indicator	Percentage	Categories
1	Contribute actively	58%	Enough
2	Work productively	55%	Enough
3	Showing an attitude of responsibility	60%	Enough
4	Showing flexibility and compromise	69%	Good
5	Show mutual respect	67%	Good

Based on the results of observations, only 58% of teachers actively contribute to conveying the results of thinking and solving problems, this is because teachers still rely on each other. Teachers who work productively are only 55% of teachers who actively discuss, work effectively and efficiently and communicate fluently. This is because teachers still do not understand the common goals to be achieved or in other words only follow decisions. In the third indicator, only 60% of teachers have an attitude of responsibility in completing their tasks and can be on time in completing them. This is because teachers rely on each other so they do not understand their functions and roles in the learning process. As for the indicators showing flexibility and compromise as well as an attitude of appreciation, they are included in the good category.

This result was obtained when teachers only carried out learning at the end of the project which was carried out jointly where each teacher carried out his function as a facilitator without the role of the teaching team leader who provided direction to the implementation of the project. As well as the absence of communication and discussion in the implementation stage so that a clear division of tasks has not been established between the teachers involved. As a result, in the implementation of joint projects, they rely on each other.

Significant changes occurred when the second project was implemented in a multidisciplinary manner, in this project there was a teaching team leader who gave instructions that had to be implemented before the implementation of the project. The formation of the teaching team is based on the project to be implemented. In this second project, the theme of fast fashion problems that cause textile waste problems. Based on the project that will be carried out, the teachers involved are science teachers, social studies, ICT, language and problem solving. Because this problem raises social themes that occur in society, the team leaders in both 7th and 8th grades are chaired by social studies teachers.

Before the implementation of learning, a discussion was held first regarding the indicators of achievement to be achieved in the project and also in each subject. The goal of this project is in the form of education for parents of students carried out by students. In grade 7, they carry out a fashion show of clothes that are designed with various techniques to be exhibited and shown. Meanwhile, grade 8 provides training to parents to redesign clothes that have not been used for a long time to be able to wear with new designs.

The techniques carried out are by applying sequins, embroidery, tie dye and eco prints on clothes, veils, tote bags, bandanas, pants, and so on. Each teacher has their own role as a mentor team as well as a facilitator for each student group that has been formed according to the redesign method. In addition to the planning stage, discussions are also carried out when problems occur during the project preparation process, in addition to debriefing before the implementation of the project to ensure that the project runs according to the target.

Based on this implementation, there was a significant change in teachers' collaboration skills in the implementation of multidisciplinary project-based learning. These results are listed in table 4.

Table 4. Percentage of Collaboration Skills After Multidisciplinary Project Based Learning

No	Indicator	Percentage	Categories
1	Contribute actively	76%	Good
2	Work productively	86%	Excellent
3	Showing an attitude of responsibility	94%	Excellent
4	Showing flexibility and compromise	89%	Excellent
5	Show mutual respect	90%	Excellent

The results are also illustrated in the following diagram:

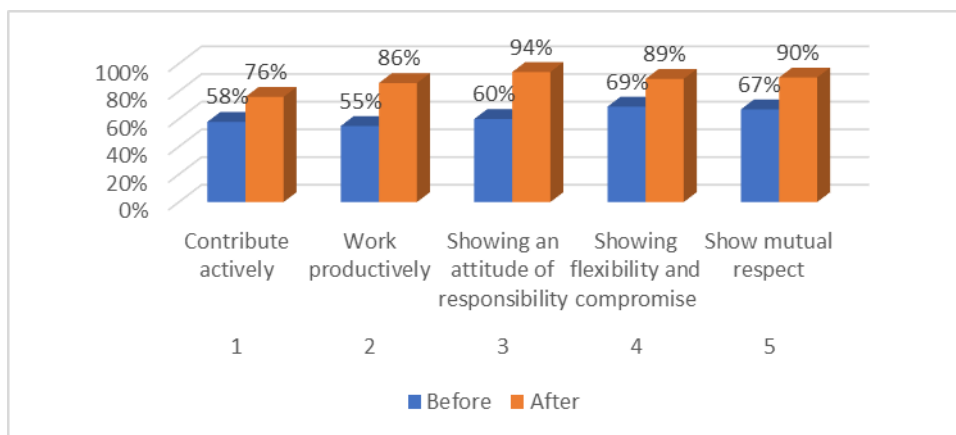


Fig. 1. Differences in Collaboration Skills Before and After Multidisciplinary Project Based Learning.

The results of the indicator on active contribution increased by 18% from 58% to 76%. Almost all teachers have contributed to providing the results of their thinking in the project planning stage and providing problem solving. This is because there is a team leader who provides directions and planning documents for each teacher to understand the target indicators of achievement to be achieved in the implementation of the project and the existence of an agreed time line in each stage of the project. The indicator of working productively increased to 86% from 55%, each teacher worked effectively and efficiently, discussions were more directed and solutions were produced. This is because teachers already understand the goals that will be achieved by debriefing in each stage of implementation, both during trials and exhibitions of works.

The most significant change is in the attitude of responsibility of each member which has increased to 94% from the original 60%. At this point, it increased by 34%, the effectiveness of planning had a significant impact on the overall change of the indicator. In addition to the indicators that will be achieved, it is also the determination of the schedule for the completion of learning, the practice of making products, deadlines, coordination meetings, to the implementation of product exhibitions or project expose which is held at School of Human Junior High School. Categorical change is also found in flexibility and compromise as well as mutual respect. The existence of cooperation that has been carried out since planning makes each team member have the same vision and goals for the project that is carried out until the process of product assessment and exhibition.

There is an improvement in collaboration skills with the existence of a multidisciplinary project-based learning process in addition to improving teachers' collaboration skills both in indicators of active contribution, working productively, an attitude of responsibility for project success, flexibility and compromise in overcoming problems, and an attitude of mutual respect also has an impact on the student learning process, including students understanding the interconnectedness of subjects in completing projects, students' cooperation skills, critical thinking skills, and the impact

of the teaching process carried out. This is reflected in the results of the reflection carried out when students are asked to reflect on the benefits of subjects related to the redesign project, what is memorable after implementing the project, and what they learn and can apply after the implementation of the project-based learning.

In line with what was conveyed by [2] that multidisciplinary project-based learning can improve teamwork skills. In addition to improving collaboration skills, this learning model can improve communication skills, creative and innovative, problem solving, and also connect skills and knowledge in each contributing subject [11]. These results also prove that there is an increase in knowledge, skills, and attitudes [12].

References

- [1] N. Rehman, X. Huang, A. Mahmood, M. A. M. AlGerafi, and S. Javed, "Project-based learning as a catalyst for 21st-Century skills and student engagement in the math classroom," *Helijon*, vol. 10, no. 23, Dec. 2024, doi: 10.1016/j.helijon.2024.e39988.
- [2] E. Dias-Oliveira, R. Pasion, R. Vieira da Cunha, and S. Lima Coelho, "The development of critical thinking, team working, and communication skills in a business school—A project-based learning approach," *Think Skills Creat*, vol. 54, Dec. 2024, doi: 10.1016/j.tsc.2024.101680.
- [3] L. Mebert *et al.*, "Fostering student engagement through a real-world, collaborative project across disciplines and institutions," *High Educ Pedagog*, vol. 5, no. 1, pp. 30–51, Jan. 2020, doi: 10.1080/23752696.2020.1750306.
- [4] A. E. Carvalho, S. Blanc, M. Aguiar, and A. C. Torres, "Fostering Diversity and Participation with School Gardens: Examining Possibilities and Challenges under Different National Educational Policies," *Educational Process: International Journal*, vol. 13, no. 2, pp. 122–138, 2024, doi: 10.22521/edupij.2024.132.8.
- [5] M. Maesala and F. Ronél, "Overcoming the Challenges of Including Learners with Visual Impairments Through Teacher Collaborations," *Educ Sci (Basel)*, vol. 14, no. 11, Nov. 2024, doi: 10.3390/educsci14111217.
- [6] Y. Yan, M. Zuo, and H. Luo, "Investigating co-teaching presence and its impact on student engagement: A mixed-method study on the blended synchronous classroom," *Comput Educ*, vol. 222, p. 105153, Dec. 2024, doi: 10.1016/j.compedu.2024.105153.
- [7] A. C. Alves, N. Van Hattum-Janssen, and S. Fernandes, "Teacher collaboration in PBL: Setting the example for the students," in *International Symposium on Project Approaches in Engineering Education*, University of Minho, 2021, pp. 6–14. doi: 10.5281/zenodo.5093791.
- [8] A. P. Susilo, E. Setiawan, and I. M. P. Wibowo, "Behind the scenes: teachers collaboration to facilitate interprofessional education between medical and pharmacy students in Indonesia," *Korean J Med Educ*, vol. 36, no. 4, pp. 449–452, Dec. 2024, doi: 10.3946/kjme.2024.317.

- [9] L. Greenstein, "Assessing 21st century skills : a guide to evaluating mastery and authentic learning," USA, 2012. [Online]. Available: <https://archive.org/details/assessing21>
- [10] E. P. Widyoko, *Evaluasi Program Pembelajaran*. Yogyakarta: Pustaka Pelajar, 2009.
- [11] Y. Rahmawati *et al.*, "Engaging university students in multidisciplinary, project-based learning through the Southeast Asia mobility (SAM) program," in *AIP Conference Proceedings*, American Institute of Physics Inc., Apr. 2021. doi: 10.1063/5.0041913.
- [12] Y. Campos-Roca, "Multidisciplinary Project-Based Learning: Improving Student Motivation for Learning Signal Processing," *IEEE Signal Process Mag*, vol. 38, no. 3, pp. 62–72, May 2021, doi: 10.1109/MSP.2021.3053538.