JUPE : Jurnal Pendidikan Mandala
Vol. 11 No. 2 Juni 2026
P-ISSN: 2548-5555, *E-ISSN:* 2656-6745
DOI: *https://ejournal.mandalanursa.org/index.php/JUPE/index*

The Effectiveness of Implementing a Project-Based Learning Model in Enhancing Student Collaboration in the Development of Game-Based Media

Firdiawan Ekaputra
Universitas Jambi

Article Info

Article history:
Accepted: 24 Mei 2026
Publish: 18 Juni 2026

Keywords:
Project-based learning;
Collaboration;
Media.

Abstract

This study aims to examine the effectiveness of project-based learning model in improving student collaboration in game-based media development. This research is a pre-experimental research because the research sample consists of one experimental class and does not involve a control class. In this study, the sample used was 21 students from the Jambi University Chemistry Education Study Program who took the chemistry learning gamification course in the 2023/2024 academic year. The method used to collect student collaboration data is the questionnaire method. Data on collaboration in the sample class were collected twice, namely before and after the application of the project-based learning model in the sample class. The hypothesis test results obtained a significance value of 0.00 or smaller than 0.05, so that the application of the project-based learning model was effective in improving student collaboration skills in the sample class. In this study, it can be concluded that applying a project-based learning model improves students' ability to work together.

Corresponding Author:
Firdiawan Ekaputra
Universitas Jambi, Indonesia
Email Coresspondent: firdiawan.ekaputra@unja.ac.id

1. INTRODUCTION

The 4C skills are essential for students to thrive in an era of rapid change. The 4C skills include critical thinking, creativity, communication, and collaboration (Sari & Trisnawati, 2019). These 4C skills are fundamental for preparing graduates to navigate a world that is constantly and rapidly changing (Lestari & Hindun, 2023). Learning in higher education not only requires students to master course material but also 4C skills such as collaboration.

Collaboration is working together in a group to achieve a common goal (Batoebara, 2021). Collaboration skills are one of the key competencies that students must master, particularly after graduating from college, because in the professional world, graduates must possess the ability to work effectively in teams, communicate well with fellow team members, share responsibilities for assigned tasks to achieve common goals, and collectively resolve challenges encountered (Maulidya & Insani, 2026). Collaboration is the skill of working together with others to achieve a learning objective (Nugraha & Rahman, 2017).

Field observations indicate that students have limited ability to collaborate with other group members; they prefer to divide the assigned tasks and then compile the completed work. This results

in collaboration skills that do not develop optimally. Technological advancements that make life easier for students have led to a rise in individualism among them (Munawaroh et al., 2025). Therefore, a learning model is needed to improve students' collaboration skills. In this study, the project-based learning model is considered the appropriate learning model for improving students' collaboration skills.

Project-based learning is meaningful because it fosters independence in problem-solving and decision-making (Prasetyo, 2019). The project-based learning model involves students actively working to complete assigned projects. The presence of these projects makes the learning process interactive, enabling it to proceed effectively and making the material easier to understand (Nisa & Nugraheni, 2021). A project-based learning model that involves students can improve their ability to solve problems they face (Apriany et al., 2020). Based on the identified issues, this study will implement a project-based learning model to enhance student collaboration.

2. METHOD

This study was conducted in the Chemistry Education Program at the University of Jambi during the 2023/2024 academic year, which ran from mid-March to early May 2024. The study involved students enrolled in the gamification of chemistry learning course as the research sample. This study is a pre-experimental study because the research sample consisted of a single experimental class and did not include a control class. In this study, the sample consisted of 21 students from the Chemistry Education Study Program at the University of Jambi who were taking the gamification of chemistry learning course during the 2023/2024 academic year. In this study, the application of the project-based learning model—specifically, a project to develop game-based learning media from unused materials—served as the independent variable, while the dependent variable was the students' collaboration skills.

The method used to collect data on student collaboration was a questionnaire. Data regarding collaboration in the sample class was collected twice: before and after the implementation of the project-based learning model in the sample class. The initial collaboration questionnaire was administered to assess students' initial collaboration skills in the sample class, ensuring that the learning model to be implemented aligns with the challenges identified in the field. The final collaboration questionnaire was administered to assess students' final collaboration skills in the sample class after the implementation of the project-based learning model, thereby determining the effectiveness of the learning model applied to the sample class.

Data regarding collaboration before and after the implementation of project-based learning underwent a normality test to determine whether the data in the sample class followed a normal distribution. The collaboration data in the sample class was deemed to follow a normal distribution if a significance value greater than 0.05 was obtained during the normality test. In addition to the normality test, this study employed a paired sample t-test to assess the effectiveness of the project-based learning model in enhancing students' collaboration skills in the sample class. The implementation of the project-based learning model in this study is deemed effective if the results of the paired sample t-test show a significance value less than 0.05.

3. RESULTS AND DISCUSSION

Students in the sample class completed a collaboration questionnaire before participating in lectures that applied the project-based learning model. The purpose of administering the collaboration questionnaire prior to implementing the project-based learning model was to determine the students' initial level of collaboration before taking the gamified chemistry course that applied the project-based learning model. After the lecture activities using the project-based learning model were implemented in the sample class, students completed a final collaboration questionnaire aimed at determining the final collaboration skills of students in the sample class following the implementation of the project-based learning model, thereby allowing the effectiveness of the learning model applied to the sample class to be determined. The results of the students' collaboration questionnaires before and after the implementation of the project-based learning model in the sample class are presented in Table 1.

Table 1. Collaboration Ability Data

Pretest	Posttest	Gain Score
67.14	85.24	18.10

Based on the data shown in Table 1, it is evident that students' collaboration ability following the implementation of the project-based learning model in the gamified chemistry learning course increased by 18.10. Furthermore, the data regarding student collaboration was subjected to a normality test. The normality test was conducted on the difference in collaboration scores before and after the implementation of the project-based learning model. The results of the normality test on the student collaboration data are presented in Table 2.

Tabel 2. Normality Test

Significance	Result	Conclusion
0.173	> 0.05	Normal

According to the results of the normality test, the collaboration data in the sample class are normally distributed. Therefore, hypothesis testing can be conducted using a parametric test. A paired sample t-test was used in the hypothesis testing of this study to determine how effective the project-based learning model is on students' collaboration skills in the sample class. The results of the paired sample t-test used for hypothesis testing are presented in Table 3.

Table 3. Hypothesis Testing

Significance	Result	Conclusion
0.000	< 0.05	Normal

Based on the results of the paired t-test, a significance value of 0.00 was obtained. This result indicates that the significance value is less than 0.05, suggesting that the implementation of the project-based learning model can enhance students' creativity. The results of the paired t-test lead to the conclusion that there is an increase in students' creativity through the implementation of the project-based learning model in classroom activities.

A significance value of 0.00 was obtained from the results of the paired sample t-test. Based on the results of the paired sample t-test, project-based learning in this study can enhance student creativity because the significance value is less than 0.05. Based on the results of the paired sample t-test, it can be concluded that the use of the project-based learning model in classroom activities enhances student collaboration.

In this study, students were asked to develop and complete a project involving the creation of game-based learning media using recycled materials. Students were asked to form groups to complete the assigned project. The formation of groups aimed to enhance collaboration among students. Group formation can encourage students to be more active in group discussions and engage more deeply in the assigned project, resulting in a more engaging final product. Assigning projects can make students more active and boost their self-confidence (Marthinus et al., 2023).

Students were given the freedom to choose the chemistry material to be incorporated into the educational media project. Students are also given the freedom to choose the games to be developed according to their interests and imagination. Giving students the freedom to determine the material and type of game to be developed can increase student activity and motivation in learning during lectures. A fun learning model is one that provides freedom in expressing ideas and increases motivation to learn (Hendriyanto & Putri, 2014).

The implementation of the project-based learning model in the classroom gives students the freedom to decide when to plan and complete their projects. Students develop project plans that must be completed each week. This can enhance collaborative skills as students must synthesize ideas within a group. Collaborative skills in project-based learning emphasize synergistic cooperation among group members to achieve a common goal (Puspasari, 2017).

After planning, students collaborate within their groups to develop game-based learning media from recycled materials. Developing this game-based learning media enables students not only to learn from the project they are working on but also to develop their ability to interact with other team members, thereby enhancing their collaborative skills. During the development of game-based learning media projects, students often encounter challenges, such as games that cannot be fully utilized or learning materials that are not well-suited. Identifying these challenges in the field not only enhances collaboration but also fosters students' critical thinking and creativity.

Following the development of game-based learning materials made from recycled materials, a presentation was conducted in class to evaluate the developed learning materials. This evaluation is crucial because, through the presentation, students from each group can identify the strengths and weaknesses of the learning materials they had previously developed. The evaluation aims to assess the quality of the materials that had been developed (Dalu & Rohman, 2019).

Figure 1. Presentation of Results

Based on the results of the hypothesis testing conducted, this study shows that the implementation of the project-based learning model can improve students' collaboration skills. The improvement in students' collaboration skills following the implementation of the project-based learning model can indirectly enhance students' learning activities. Students were actively involved in developing plans, discussing ideas for games to be created, and making decisions based on concepts raised during group discussions. The project-based learning model is an interactive, student-centered approach to learning (Rahayu & Samsudin, 2019).

In this project-based learning, students are given hands-on experience, particularly in developing game-based learning media from recycled materials. Providing hands-on experience can make learning more meaningful for students. Learning using the project-based learning model has been proven to directly involve students in learning activities because students are involved in completing projects from planning to evaluation (Trisnayoni et al., 2024).

4. CONCLUSION

In this study, a paired sample t-test was conducted on collaboration data collected before and after the implementation of the project-based learning model. The results of the paired sample t-test in this study yielded a significance value of 0.00, which is less than 0.05; therefore, the implementation of the project-based learning model was effective in improving students' collaboration skills in the sample class. In this study, it can be concluded that implementing a project-based learning model enhances students' ability to collaborate.

5. BIBLIOGRAPHY

Apriany, W., Widi Winarni, E., & Muktadir, A. (2020). Pengaruh Penerapan Model Pembelajaran Project Based Learning (PJBL) Terhadap Hasil Belajar Kognitif Siswa Pada Mata Pelajaran IPA di Kelas V SD Negeri 5 Kota Bengkulu. *JP3D (Jurnal Pembelajaran Dan Pengajaran Pendidikan Dasar)*, *3*(1), 88–97.

Batoebara, M. U. (2021). Inovasi Dan Kolaborasi Dalam Era Komunikasi Digital. *Jurnal Publik Reform UNDHAR MEDAN*, *8*(1), 29–38.

Dalu, Z. C. A., & Rohman, M. (2019). Pengembangan E-Learning Sebagai Media Pembelajaran Simulasi dan Komunikasi Digital bagi Siswa SMK. *JUPITER (Jurnal Pendidikan Teknik Elektro)*, *04*(01), 25–33.

Hendriyanto, A., & Putri, N. P. (2014). Pengembangan Pembelajaran Berbasis Pendidikan Karakter Dengan Permainan Pada Mata Pelajaran Bahasa Indonesia Siswa Kelas X di SMK Harapan Kartasura Surakarta (Semester Genap 2013/2014). *Seminar Nasional 2014*, 36–44.

Lestari, R. V. A., & Hindun. (2023). PENERAPAN 4C (COMMUNICATION, COLLABORATION, CRITICAL THINKING, CREATIVITY) PADA KURIKULUM MERDEKA DI TINGKAT SMA. *REDUPLIKASI: Jurnal Penelitian Pendidikan Bahasa Indonesia*, *3*, 15–26. http://ejurnal.pps.ung.ac.id/index.php/Reduplikasi/

Marthinus, V., Tandirerung, W. Y., & Marewa, J. B. (2023). Penerapan Tugas Proyek Botani dalam Upaya Pembentukan Keterampilan Kerja Mahasiswa. *JURNAL KONSELING GUSJIGANG*, *9*(2), 231–243. https://doi.org/10.24176/jkg.v9i2.8748

Maulidya, S. R., & Insani, S. U. (2026). Urgensi Keterampilan Kolaborasi di Perguruan Tinggi. *Jurnal Pustaka Cendekia Hukum Dan Ilmu Sosial*, *3*(3), 413–420. https://doi.org/10.70292/pchukumsosial.v3i3.196

Munawaroh, F., Handayani, S., & Nur, D. M. M. (2025). Individualisme di Kalangan Mahasiswa di Era Digital dan Implikasinya Terhadap Nilai-Nilai Sosial dalam Pendidikan IPS. *JPIM: Jurnal Penelitian Ilmiah Multidisipliner*, *02*(03), 2577–2583.

Nisa, A. R. K., & Nugraheni, A. S. (2021). EFEKTIVITAS MODEL PEMBELAJARAN BERBASIS PROYEK DALAM PJJ TERHADAP PEMAHAMAN MATERI. *Alinea: Jurnal Bahasa, Sastra, Dan Pengajaran*, *10*(1), 61–66.

Nugraha, A., & Rahman, F. A. (2017). Strategi Kolaborasi Orangtua Dengan Konselor Dalam Mengembangkan Sukses Studi Siswa. *Jurnal Konseling GUSJIGANG*, *3*(1), 128–136. https://doi.org/10.24176/jkg.v3i1.1605

Prasetyo, F. (2019). *Pentingnya Model Project Based Learning Terhadap Pemahaman Konsep di IPS*.

Puspasari, R. (2017). Implementasi Project Based Learning Untuk Meningkatkan Kemandirian dan Prestasi Belajar Mahasiswa dalam Pembuatan Alat Peraga Matematika Inovatif. *Math Didactic: Jurnal Pendidikan Matematika*, *3*(1), 10.

Rahayu, G. D. S., & Samsudin, A. (2019). Penerapan Model Project Based Learning Dalam Meningkatkan Keterampilan Penyusunan Rencana Pelaksanaan Pembelajaran (RPP) Mahasiswa PGSD IKIP Siliwangi. *Jurnal Ilmiah UPT P2M STKIP Siliwangi*, *6*(2), 196.

Sari, A. K., & Trisnawati, W. (2019). Integrasi Keterampilan Abad 21 Dalam Modul Sociolinguistics: Keterampilan 4c (Collaboration, Communication, Critical Thinking, Dan Creativity). *Jurnal Muara Pendidikan*, *4*(2), 456–466.

Trisnayoni, R. A., Puspita, N. P. L. A., & Dewi, N. W. S. (2024). Implementasi Model Pembelajaran Berbasis Project Based Learning Untuk Meningkatkan Pemahaman Mahasiswa Terhadap Praktik Organizing Event. *Jurnal Ilmiah Pariwisata*, *29*(2), 159–168. https://doi.org/10.30647/jip.v29i2.1796