

# Increasing Student Creativity and Collaboration in Biochemistry Practicum through the Application of Project Based Learning Model

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## Abstract

Finding out how well project-based learning works in biochemistry practicum courses to foster student creativity and teamwork was the aim of this study. One research sample class and a pre-experiment design were employed in this investigation. The samples used in this study were Jambi University Chemistry Education Study Program students who took the Biochemistry Practicum course, class R-002, during the 2023–2024 academic year. Questionnaire tools were employed in this study to gather data on teamwork and creativity. The difference in student creativity and collaboration data before and after the application of the project-based learning model was then tested for normality to determine the distribution of data for each variable and paired sample t-test to determine the effectiveness of the application of the project-based learning model. The significance results based on the paired sample t-test showed 0.000 for the creativity variable and 0.003 for the student collaboration variable. Based on these results, it can be concluded that the application of the project-based learning model in biochemistry practicum courses is effective in increasing student creativity and collaboration.

*Keywords:* Creativity; Collaboration; Project-Based Learning Model.

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## 1. Introduction

The world of education in Indonesia is undergoing rapid changes through changes in the MBKM curriculum. Changing the curriculum to the MBKM (Merdeka Belajar Kampus Merdeka) curriculum is a step taken by the Indonesian government to improve the quality of learning and keep up with the times. Improving the quality of education can be done by adapting to the times and applying it in daily learning activities (Fuldiaratman & Ekaputra, 2023).

Improving the quality of education can not only be done by changing the existing curriculum, but by improving the quality of graduates. Providing provision in the form of skills is needed by graduates in facing the rapidly changing times. Debriefing to students is needed to improve the competencies possessed by students (Hendra et al., 2023). The rapidly changing times make students need to equip themselves with 4C skills (Ekaputra & Widarwati, 2023). 21st century skills or 4C skills include creativity, critical thinking, collaboration, and communication. Creativity and collaboration skills are important skills to have and develop, especially in lectures in the form of practicum.

According to observations in the field, students' ability to develop creativity and collaboration, especially in practicum activities, cannot be fully facilitated. In practicum activities, students tend to divide tasks in completing tasks and collecting the results of their respective work, so collaboration in practicum activities is not maximized. Student creativity in practicum activities must be well facilitated because students can find problems in the unavailability of practicum supporting materials and tools. Creativity in practicum is needed especially in finding alternative substitutes for unavailable tools and materials. The application of the project-based learning model is a suitable learning model to improve the ability of student creativity and collaboration.

According to Andrini et al. (2019), the project-based learning model places students at the center of learning, making it a dynamic learning paradigm. Participating actively in learning activities can raise students' comprehension of a subject matter notion (Ekaputra, 2023). A person's capacity for learning is demonstrated by their ability to read, pay attention

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to how the content is delivered, ask and answer questions, participate in discussions, and listen to opposing viewpoints (Ekaputra & Hasanah, 2021).

In order to foster greater student creativity and teamwork, this study focuses on using the project-based learning approach to biochemistry practicum instruction. The aim of this research is to investigate how the project-based learning paradigm improves students' creativity and collaboration.

## **2. Literature Review**

### *2.1. Creativity*

Creativity is a process that a person does to produce new ideas, processes, methods, products, or discontinuities that are useful in solving a problem (Kusmiati et al., 2021). Creativity is the ability to use thinking and create something new or develop an existing one (Waritsman, 2020). Creativity is not always creating something completely new, but students can also combine existing ideas and ideas to create something new (Zakiah et al., 2020).

### *2.2. Collaboration*

Collaboration is cooperation in a group to achieve a common goal (Batoebara, 2021). In the collaboration process, the focus of attention includes the dynamics of collaboration, collaboration-action, impact and adaptation in the collaboration process (Aprilia, 2023). Collaboration in a learning activity has a positive impact on learning outcomes (Mardiyaini, 2020).

### *2.3. Project Based Learning Model*

The project-based learning model is a learning model that allows students to create a product from a given task creatively and present the product (Elisabet et al., 2019). Project-based learning is meaningful learning because it facilitates independence in solving problems and making decisions (Prasetyo, 2019). Learning that can involve students directly can improve learning outcomes (Ekaputra & Sanova, 2023).

## **3. Research Methods**

This study employs a quantitative methodology and one sample class in a pre-experimental investigation. Students participating in the biochemistry practicum in Jambi University's Chemistry Education Study Program's R-002 during the 2023–2024 academic year served as the study's samples. Students' creativity and teamwork are the independent variables in this study, while the project-based learning paradigm used in the sample class is the dependent variable. Both before and after the project-based learning paradigm was introduced in the sample class, questionnaires were utilized to collect data on the students' creativity and collaboration. to determine whether there are any differences between the sample class's normal distribution and the results of their collaboration and creativity before and after the project-based learning model was introduced to the class. The purpose of the normality test was to ascertain the sample class's normal distribution and find variations in the levels of student creativity and teamwork prior to and following the implementation of project-based learning methods. The next step is to use a project-based learning model to run a paired sample t-test to find out if there has been a substantial increase in student creativity and teamwork in the biochemistry practicum. If the significance value is more than 0.05, there will be a notable improvement in the creativity and collaboration of the students throughout their biochemistry practicum while employing a project-based learning approach.

## **4. Results and Discussion**

The purpose of this study is to evaluate how well students' creativity and teamwork are affected when a project-based learning paradigm is implemented in the biochemistry practicum. Students had to fill out a questionnaire about creativity and teamwork before the project-based learning paradigm was introduced in the sample class. Based on the results of the initial questionnaire, Table 1 shows the average score of 69.00 for both creativity and collaboration. The average indicates that the project-based learning methodology in the biology class R-001 will require an effort to enhance student creativity and collaboration.

Students completed the final creativity and collaboration questionnaire once more following the introduction of the project-based learning paradigm in class R-002. Based on the results of the final creativity and collaboration questionnaire in Table 1, there is an increase in creativity and collaboration. The increase in creativity was 17.27 and collaboration was 12.73. The increase can be due to the fact that in practicum activities there are materials and tools available, so students look for alternative materials for practicum activities. That is what makes student creativity experience the biggest increase.

**Table 1.** Critical Thinking and Collaboration Results

Variable	Initial Value	Final Value	Gain Score
Creativity	68.18	85.45	17.27
Collaboration	69.82	82.55	12.73
Average	69.00	84.00	15.00

Following the deployment of the project-based learning model, data on creativity and collaboration were compared. A normality test was then performed to ascertain the normal distribution of the data difference of each variable in the sample class. Based on the normality test results presented in Table 2, a significance value of 0.200 was obtained for creativity and collaboration. These results indicate that the creativity and collaboration data in the sample class are normally distributed, so it can be continued with hypothesis testing.

**Table 2.** Normality results and paired sample t-test

Variable	Normality	t-test sample paired
Creativity	0.200	0.000
Collaboration	0.200	0.003

The paired sample t-test hypothesis testing, which is displayed in Table 2, yields significance values of 0.000 for creativity and 0.003 for collaboration. This demonstrates that using a project-based learning approach in the biochemistry practicum helps students become more creative and collaborative. The research Harizon & Ekaputra, (2023) indicating that the project-based learning model has an influence on developing communication skills, critical thinking, teamwork, and student creativity is compatible with the effectiveness of the model in enhancing student skills. Project-based learning makes student creativity increase in solving and solving problems encountered in the process of completing the project (Sari & Angreni, 2018). Improving competence and learning quality can be done using a project-based learning model in learning activities (Sungkono & Ekaputra, 2023). Completing projects that must be carried out by students makes students' ability to manage time and involvement in the learning process increase (Ekawati et al., 2019). Student activeness shows the level of student involvement in the lecture process (Ekaputra, 2022).

The significant values for the creativity and student collaboration variables, respectively, were 0.000 and 0.003, according to the paired sample t-test. These findings suggest that using the project-based learning approach in biochemistry lectures helps boost students' inventiveness and teamwork. Based on the study's findings, it can be said that using the project-based learning model in the biochemistry practicum has increased students' creativity and collaboration, particularly for Jambi University students enrolled in class R-002 of the Chemistry Education Study Program for the 2023–2024 academic year.

## 5. Conclusion

The significant values for the creativity and student collaboration variables, respectively, were 0.000 and 0.003, according to the paired sample t-test. These findings suggest that using the project-based learning approach in biochemistry lectures helps boost students' inventiveness and teamwork. Based on the study's findings, it can be said that using the project-based learning model in the biochemistry practicum has increased students' creativity and collaboration, particularly for Jambi University students enrolled in class R-002 of the Chemistry Education Study Program for the 2023–2024 academic year.

## References

- Andrini, V. S., Pratama, H., & Maduretno, T. W. (2019). The effect of flipped classroom and project based learning model on student's critical thinking ability. *Journal of Physics: Conference Series*, 1171(1). <https://doi.org/10.1088/1742-6596/1171/1/012010>
- Aprilia, S. (2023). Kolaborasi Dalam Meningkatkan Destinasi Wisata Hemaq Beniung Di Kampung Juaq Asa Kecamatan Barong Tongkok Kabupaten Kutai Barat. *EJournal Pemerintahan Integratif*, 2023(1), 98–108.
- Batoebara, M. U. (2021). Inovasi Dan Kolaborasi Dalam Era Komunikasi Digital. *Jurnal Publik Reform UNDHAR MEDAN*, 8(1), 29–38.
- Ekaputra, F. (2022). Peningkatan aktivitas belajar melalui implementasi media virtual laboratorium kimia pada masa pandemi covid-19. *Tajdidukasi: Jurnal Penelitian Dan Kajian Pendidikan Islam*, 12(1), 22–26. <https://doi.org/10.47736/tajdidukasi.v12i1.334>
- Ekaputra, F. (2023). Pembelajaran Menggunakan Model Project Based Learning Berbantuan Quizwhizzer Terhadap Potensi Learning Loss Mahasiswa. *Jurnal Pendidikan Kimia Unkhair (JPKU)*, 3(2), 1–5.
- Ekaputra, F., & Hasanah, E. (2021). Peningkatan aktivitas belajar melalui implementasi media virtual laboratorium kimia pada masa pandemi covid-19. *Tajdidukasi: Jurnal Penelitian Dan Kajian Pendidikan Islam*, 11(1), 11–16. <https://doi.org/10.47736/tajdidukasi.v11i1.348>
- Ekaputra, F., & Sanova, A. (2023). Penerapan Model Pembelajaran Flipped Classroom-Pjbl Dalam Mengurangi Potensi Learning Loss dan Meningkatkan Hasil Belajar Mahasiswa. *Judika (Jurnal Pendidikan Unsika)*, 11(1), 33–43. <https://doi.org/10.35706/judika.v11i1.8312>
- Ekaputra, F., & Widarwati, S. (2023). Discovery Learning Based Practicum Learning in Improving Critical Thinking Skill and Student Creativity. *Tarbiyah: Jurnal Ilmiah Kependidikan*, 12(1), 47–56. <https://doi.org/10.18592/tarbiyah.9183>
- Ekawati, N. P. N., Dantes, N., & Marhaeni, A. A. I. N. (2019). Pengaruh Model Project Based Learning Berbasis 4C Terhadap Kemandirian Belajar dan Kemampuan Membaca Pemahaman Pada Siswa Kelas IV SD Gugus III Kecamatan Kediri Kabupaten Tabanan. *PENDASI: Jurnal Pendidikan Dasar Indonesia*, 3(1), 41–51.
- Elisabet, Relmasira, S. C., & Hardini, A. T. A. (2019). Meningkatkan Motivasi dan Hasil Belajar IPA dengan Menggunakan Model Pembelajaran Project Based Learning (PjBL). *Journal of Education Action Research*, 3(3), 285–291. <https://ejournal.undiksha.ac.id/index.php/JEAR/index>
- Fuldariatman, F., & Ekaputra, F. (2023). Analysis of Students' 4C Skills Based on Project Based Learning through Chemo Entrepreneurship Media. *EduLine: Journal of Education and Learning Innovation*, 3(3), 454–459. <https://doi.org/10.35877/454RI.eduline2057>
- Harizon, H., & Ekaputra, F. (2023). Application of PjBL Model by Utilizing Natural Materials Chemistry to Improve Students' 4C Skills. *EduLine: Journal of Education and Learning Innovation*, 3(3), 479–483. <https://doi.org/10.35877/454RI.eduline2060>
- Hendra, Candra, A. A., & Ekaputra, F. (2023). Meningkatkan Keterampilan Berpikir Kritis Mahasiswa Melalui Kegiatan Pendampingan Penulisan Gagasan Pada Artikel: Indonesia. *ESTUNGKARA*, 2(1), 24–32.
- Kusmiati, E., Chabibah, N., & Rizkiah, M. K. (2021). Penerapan Model Pictorial Riddle Dalam Meningkatkan Kreativitas Belajar Siswa Pada Pembelajaran IPS. *Jurnal Tahsinia (Jurnal Karya Umum Dan Ilmiah)*, 2(2), 114–123.
- Mardiyaini. (2020). Upaya Meningkatkan Prestasi Belajar Pendidikan Agama Islam Dengan Menerapkan Model Pengajaran Kolaborasi Pada Siswa Kelas VI SD Negeri 101731 Kp. Lalang Kec. Sunggal Tahun Pelajaran 2015/2016. *Journal of Education and Teaching Learning (JETL)*, 8(1), 38–46.
- Prasetyo, F. (2019). Pentingnya Model Project Based Learning Terhadap Pemahaman Konsep di IPS.
- Sari, R. T., & Angreni, S. (2018). Penerapan Model Pembelajaran Project Based Learning (PjBL) Upaya Peningkatan Kreativitas Mahasiswa. *Varia Pendidikan*, 30(1), 79–83.

- Sungkono, S., & Ekaputra, F. (2023). Effectiveness of project-based learning model on improving critical thinking skills and student creativity. *Daengku: Journal of Humanities and Social Sciences Innovation*, 3(5), 859–863. <https://doi.org/10.35877/454ri.daengku2063>
- Waritsman, A. (2020). Kreativitas Guru Dalam Mengajar Untuk Meningkatkan Motivasi Belajar Siswa di MA Madinatul Ilmi DDI SIAPO. *NUSANTARA: JURNAL ILMU PENDIDIKAN*, 1(2), 27–34.
- Zakiah, N. E., Fatimah, A. T., & Sunaryo, Y. (2020). Implementasi Project-Based Learning Untuk Mengeksplorasi Kreativitas Dan Kemampuan Berpikir Kreatif Matematis Mahasiswa. *Teorema: Teori Dan Riset Matematika*, 5(2), 285–293. <https://jurnal.unigal.ac.id/index.php/teorema/article/view/4194>