



Discovery Learning Based Practicum Learning in Improving Critical Thinking Skill and Student Creativity

Firdiawan Ekaputra*

Chemistry Education Study Program, Universitas Jambi, Jambi, Indonesia

Sri Widarwati

Fashion Engineering Education Study Program, Universitas Negeri Yogyakarta,
Daerah Istimewa Yogyakarta, Indonesia

*Correspondence author: firdiawan.ekaputra@unja.ac.id

DOI: <http://dx.doi.org/10.18592/tarbiyah.9183>

Key Words:

creativity
critical thinking
discovery learning
practical learning

Received : 28 April 2023

Revision : 29 May 2023

Accepted : 26 June 2023

Published : 29 June 2023

Abstract:

Memorization activities in learning make students' critical thinking skills and creativity unable to develop. This study aimed to determine the effectiveness of the discovery learning model in practicum activities in improving students' critical thinking skills and creativity. The research design is a quasi-experimental model. The sample used in this study were students of the Chemistry Education Study Program at Jambi University who took the inorganic chemistry practicum course in the 2022/2023 academic year, class R-002, the experimental class, and class R-004, the control class. The questionnaire instrument obtained data on critical thinking skills and creativity. Data analysis techniques to determine the increase in critical thinking skills and creativity after applying the discovery learning model using the Manova test. The results of this study indicate that practicum learning with the discovery learning model effectively increases students' critical thinking and creativity, especially for Chemistry Education students at Jambi University who are conducting Inorganic Chemistry practicum in the 2022/2023 academic year.

To cite this article: 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. <http://dx.doi.org/10.18592/tarbiyah.9183>

This is an open access article under the CC-BY License
(<https://creativecommons.org/licenses/by/4.0/>)



Introduction

Advances in science and technology are changing rapidly and impact the world of education. The application of technology in learning can display and explain material and particles in micro sizes to make it easier to see and understand. However, it has negative impacts, such as students' emergence of individualistic traits. The convenience offered by using technology also makes people less critical and creative in dealing with a problem. Students dependent on the virtual world are less critical ([Jamun, 2018](#)). Changes in social attitudes from the rapid development of technology will create severe problems for the younger generation of the Indonesian nation if not appropriately handled.

The Indonesian government, especially the Ministry of Education, Culture, Research and Technology, is providing 4C skills or 21st-century skills to prepare students and students to face the fast-changing times. The 4C skills include critical thinking, creativity, collaboration and communication. The change in curriculum is an effort by the Indonesian government to improve the quality of graduates and competency outcomes from primary education to higher education. The curriculum used in educational units from elementary to high levels is adapted to the conditions and demands of the times ([Hendra et al., 2023](#)).

Based on observations made by several semester six students of the Chemistry Education Study Program at Jambi University, implementing learning in the laboratory does not facilitate the development of student's critical thinking and creativity. The same thing is found in research conducted by [Ningsyih et al., \(2016\)](#) which states that learning and efficient work still needs to be improved in facilitating critical thinking. Students tend to memorize the instructions for practicum instructions before doing a practicum in the laboratory. The observation results were strengthened by filling in a questionnaire regarding critical thinking skills and early creativity, showing an average of 73.9 in data in the experimental class and 74.0 in data in the control class. The results regarding critical thinking skills and creativity were classified as low because they had yet to reach a value of 75. One effort to improve students' critical thinking skills and creativity is to apply learning models such as the discovery learning model in learning activities.

The discovery learning model is a model in the learning process in which students form knowledge independently ([Burais et al., 2016](#)). The discovery learning model is a learning model that requires students to be active in discovering their knowledge based on observations made ([Astari et al., 2018](#)). The discovery learning model has its characteristics, such as facilitating problem-solving to form knowledge, directly involving students, and combining newly acquired knowledge with prior knowledge ([Prasetyo & Abduh, 2021](#)). The stages of implementing learning with the discovery learning model are stimulation, problem statement, collecting data, processing data, and verifying ([Jana & Fahmawati, 2020](#)).

The discovery learning model, which has active learning characteristics, can make students more creative and critical of the problems they encounter. Based on the background that has been described, this research aims to determine the effectiveness of applying the practicum learning model with the discovery learning model in improving students' critical thinking skills and creativity. Therefore, it is

necessary to apply discovery learning in learning inorganic chemistry. So, this study aimed to determine the effectiveness of the discovery learning model in practicum activities in improving students' critical thinking skills and creativity.

Research Method

The research design is a quasi-experimental model. The sample used in this study were students of the Chemistry Education Study Program at Jambi University who took the inorganic chemistry practicum course in the 2022/2023 academic year. The research subjects consisted of two classes: experimental and control. Class R-002 is the experimental class, and class R-004 is the control class.

The independent variable in this study is the use of discovery learning models in the experimental class and conventional learning models in the control class. In contrast, the dependent variable used in this study is critical thinking and creativity. The data collection technique used in this study was a questionnaire to obtain information about students' critical thinking and creativity as a pretest and posttest. Before implementing practical learning activities with the discovery learning model, questionnaires were distributed to determine students' critical thinking skills and initial creativity in both the experimental and control classes, follows aspect in Table 1.

Table 1. Critical Thinking and Creativity Aspect

| Statement | Critical Thinking Aspect | Creativity Aspect |
|-----------|--------------------------------------|-------------------------|
| 1 | Drawing Conclusion | Idea |
| 2 | The Appropriateness with Instruction | Interest |
| 3 | Interpreting Result | Suggestion |
| 4 | Analyzing Result | Confident |
| 5 | Giving Reason | Solution as alternative |

The questionnaire uses a Likert scale of always, often, sometimes, rarely, and never. The questionnaire instrument has been tested for validation and reliability. With the test results, all statements are valid, and the questionnaire instrument is declared reliable. The results of the questionnaire entries were changed to a scale of 100 to make it easier to see changes after treatment. The results of filling out the questionnaires for the experimental and control classes were then tested for normality and homogeneity to determine whether the data on critical thinking and creative skills for both classes were typically and homogeneously distributed. The data obtained is generally distributed if the significance value is more significant than 0.05. In the homogeneity test, both sample classes come from homogeneous groups if the significance value exceeds 0.05.

According to [Riduwan \(2011\)](#) students' critical thinking skills are divided into five criteria presented in Table 2.

Table 2. Critical Thinking Criteria

| Range | Criteria |
|---------|-----------|
| 81 -100 | Very High |
| 61 - 80 | High |
| 41 - 60 | Medium |
| 21 - 40 | Low |
| 0 - 20 | Very Low |

The level of student creativity is also divided into several criteria, such as critical thinking skills. According to [Sari & Angreni \(2018\)](#) creativity is divided into five criteria in Table 3.

Tabel 3. Creativity Criteria

| Range | Criteria |
|---------|-----------|
| 81 -100 | Very High |
| 61 - 80 | High |
| 41 - 60 | Medium |
| 21 - 40 | Low |
| 0 - 20 | Very Low |

The results of filling out the questionnaires for the experimental and control classes were then tested for normality and homogeneity to determine whether the data on critical thinking and creative skills for both classes were typically and homogeneously distributed. The data obtained is stated to be generally distributed if the significance value is more significant than 0.05. In the homogeneity test, both sample classes come from homogeneous groups if the significance value exceeds 0.05.

In four meeting sessions, inorganic chemistry practicum activities were carried out using the discovery learning model. Students then complete a questionnaire about critical thinking skills and final creativity. Data on initial and final critical thinking skills and creativity obtained were tested with the Manova test to determine whether critical thinking skills and creativity increased after applying the discovery learning model. In this study, when the significance of the hypothesis test results was less than 0.05, the practical learning model with the discovery learning model effectively increased students' critical thinking and creativity.

Finding and Discussion

This study aimed to determine the effectiveness of the discovery learning model in practicum activities in improving students' critical thinking skills and creativity. Before applying the discovery learning model, students taking inorganic chemistry practicum courses fill out a questionnaire to assess students' critical thinking and original creativity. The results of students' critical thinking and creativity are shown in Table 4.

Table 4. Pre-Critical Thinking Skill and Creativity

| Indicator | Experiment Class | Control Class |
|-------------------|------------------|---------------|
| Critical Thinking | 74,3 | 73,9 |
| Creativity | 73,5 | 74,1 |
| Average | 73,9 | 74,0 |

Based on the results of the questionnaire on students' initial critical thinking skills, Table 1 shows that the value of critical thinking skills in the experimental class was 74.3, and the control class was 73.9. These results are classified as high criteria, so students' initial critical power needs to be very high. The questionnaire results from the students' initial creative abilities in Table 1 show that the value of the creative skill in the experimental class was 73.5, and the control class was 74.1. These results are classified as high criteria, so the initial creation of students needs to be increased to very high.

The results obtained were then tested for normality in both sample classes to determine whether the two classes' critical thinking and creativity data were usually distributed. The normality test results for the two sample classes are shown in Table 5.

Table 5. Normality Test

| Variable | Class | Sig. | Distribution |
|-------------------|------------|-------|--------------|
| Critical Thinking | Experiment | 0,200 | Normal |
| | Control | 0,200 | Normal |
| Creativity | Experiment | 0,200 | Normal |
| | Control | 0,200 | Normal |

The normality test results showed that in both sample classes and the two variables measured, all significant values were greater than 0.05, so the data obtained were usually distributed. In addition to the normality test, the homogeneity of the baseline data for critical thinking and creativity was also tested in this study. The aim is to determine whether the variance of the experimental and control classes is homogeneous. The results of the homogeneity test for critical thinking and creativity variables are presented in Table 6.

Table 6. Homogeneity Test

| Variable | Sig. | Description |
|-------------------|-------|-------------|
| Critical Thinking | 0,331 | Homogene |
| Creativity | 0,220 | Homogene |

The results of the homogeneity test in Table 6 show a significance value greater than 0.05, so it can be concluded that the critical thinking and creativity data obtained from the two sample classes came from a homogeneous group.

Discovery learning is a model that can be used to improve student learning outcomes, especially in simple experiments (Putra et al., 2020). The involvement of students in learning is reflected in the effectiveness of students in solving the problems they face (Ekaputra, 2022). Discovery learning facilitates the teacher's understanding of the material through observation, asking questions, conducting

experiments, and connecting and communicating results ([Putri et al., 2017](#)).

A learning process that can encourage the development of critical and creative thinking skills makes the basic learning process attractive because it is student-centered and increases learning motivation ([Sanova et al., 2022](#)). Learning not focusing on students as learning resources causes low learning motivation ([Ekaputra, 2020](#)). Lecture activities with the discovery learning model begin with stimulation, such as in the iron chemistry experiment, students are asked to observe the condition of iron in the vicinity of the laboratory, students identify which iron is easily corroded and which is not, students strengthen arguments by conducting iron chemistry experiments, students collect data and processing data from experimental results, students match experimental results with existing theories, the last stage students conclude from the experiments carried out. After four sessions using the discovery learning model, students returned to fill in the final critical thinking and creativity questionnaire. The results of students' critical thinking and creativity are shown in Table 7.

Table 7. The Result of Critical Thinking Skill and Creativity

| Indicator | Class | Pre-Score | Post-Score | Gain Score |
|-------------------|------------|-----------|------------|------------|
| Critical Thinking | Experiment | 74,3 | 86,4 | 12,1 |
| | Control | 73,9 | 78,1 | 4,2 |
| Creativity | Experiment | 73,5 | 88,3 | 14,8 |
| | Control | 74,1 | 77,9 | 3,8 |

The initial and final critical thinking and creativity values were obtained using the Manova test with the SPSS application and received a significance value of 0.00 or less than 0.05. The results of the Manova test, which are less than 0.05, indicating that the direct learning model with the discovery learning model effectively increases students' critical thinking and creativity compared to conventional learning. Increasing critical thinking skills after applying the discovery learning model also occurs in research by [Nurrohmi et al., \(2017\)](#); [Setyawan & Kristanti \(2021\)](#); [Wedekaningsih et al., \(2019\)](#).

Table 8. The Increasing of Critical Thinking Skill with the Discovery Learning Model

| Critical Thinking Criteria | Pre-Score | Post-Score | Gain Score |
|---------------------------------------|-----------|------------|------------|
| Drawing a conclusion | 73,9 | 86,2 | 12,3 |
| The Appropriateness with instructions | 75,4 | 89,2 | 13,8 |
| Interpreting result | 73,9 | 84,6 | 10,7 |
| Analyzing result | 73,9 | 89,2 | 15,3 |
| Giving reason | 73,9 | 83,1 | 9,2 |

Based on table 8, the increase in critical thinking skills is most significant in the criteria for analyzing experimental results 15.3. Learning in the laboratory is very compatible with the discovery learning model because students are allowed to solve practical problems. Learning activities based on discovery learning offer opportunities for students to solve problems found in joint learning with group members ([Priyambudi et al., 2019](#)). The discovery learning model involves students

directly in the learning process to improve their critical thinking skills in solving the problems they face ([Nugrahaeni et al., 2017](#)).

Table 9. The Increasing of Creativity with the Discovery Learning Model

| Critical Thinking Criteria | Pre-score | Post-score | Gain Score |
|----------------------------|-----------|------------|------------|
| Idea | 73,9 | 89,2 | 15,3 |
| Interest | 72,3 | 87,7 | 15,4 |
| Suggestion | 73,9 | 86,2 | 12,3 |
| Confidence | 75,4 | 89,2 | 13,8 |
| Solution as an alternative | 72,3 | 89,2 | 16,9 |

Applying the discovery learning model in practicum activities also influences student creativity. Based on Table 9, the criterion for student creativity that experienced the most significant increase was an alternative solution of 16.9. Practicum activities only sometimes follow theory and work methods perfectly, so students must be creative in dealing with and solving problems. In Figure 1, the tube plugs used to drain the gas were unavailable during the nitrogen experiment. Students looked for a solution using aluminium foil instead of tube plugs in the gas flow process.



Figure 1. Nitrogen Experiment

The increase in student creativity after applying the discovery learning model aligns with research [Juniarso \(2020\)](#), which found that students' creativity increased after applying the discovery learning model in the learning process. Learning activities through the discovery learning model allow students to develop creativity in completing assignments ([Sohilait, 2021](#)). The advantages of applying the discovery learning model make students active in existing practicum activities. Students exchange opinions so that creative ideas emerge from the results of critical thinking in facing obstacles in practicum activities. The discovery learning model provides an opportunity to increase creativity in completing assigned tasks ([Nurfajriani et al., 2020](#); [Nahdi & Apriadi, 2015](#)). Students must be mentally and mentally prepared to

apply discovery learning models, especially in developing an understanding. Discovery teaching is more suitable for developing an understanding (Gani et al., 2021). Based on this description, this study concludes that the practicum learning model with the discovery learning model effectively increases students' critical thinking skills and creativity, especially for Chemistry Education students at Jambi University conducting Inorganic Chemistry practicum in the 2022/2023 academic year.

Conclusion

Based on the discussion, practicum learning with the discovery learning model effectively increases students' critical thinking and creativity, especially for Chemistry Education students at Jambi University in the inorganic chemistry practicum course in the 2022/2023 academic year. Based on this, the discovery learning model must be applied to practical learning to improve students' critical thinking skills and creativity.

References

- Astari, F. A., Suroso, & Yustinus. (2018). Efektifitas Penggunaan Model Discovery Learning Dan Model Problem Based Learning Terhadap Hasil Belajar IPA Siswa Kelas 3 SD. *Jurnal Basicedu*, 2(1), 1–10. <http://stkiptam.ac.id/indeks.php/basicedu>
- Burais, L., Ikhsan, M., & Duscri, M. (2016). Peningkatan Kemampuan Penalaran Matematis Siswa melalui Model Discovery Learning. *Jurnal Didaktik Matematika*, 3(1), 77–86.
- Ekaputra, F. (2020). Efektivitas Penerapan Poseidon Meeting Classroomberbasis Pendekatan Ilmiah Materi Stoikiometri Terhadap Motivasi Dan Prestasi Belajar Peserta Didik SMA Muhammadiyah 1 Yogyakarta. *VEKTOR: Jurnal Pendidikan IPA*, 1(2), 59–65. <http://vektor.iain-jember.ac.id>
- Ekaputra, F. (2022). Peningkatan Aktivitas Belajar Melalui Implementasi Media Virtual Laboratorium Kimia Pada Masa Pandemi Covid-19. *Tajdidukasi*, 12(1), 22–26. <https://doi.org/10.47736/tajdidukasi.v12i1.334>
- Gani, R. A., Syahiril Anwar, W., & Aditiya, S. (2021). Perbedaan Hasil Belajar Melalui Model Discovery Learning Dan Problem Based Learning. *Jurnal Pendidikan Dan Pengajaran Guru Sekolah Dasar (JPPGuseda)*, 04, 54–59. <http://journal.unpak.ac.id/index.php/jppguseda>
- Hendra, Candra, A. A., & Ekaputra, F. (2023). Meningkatkan Keterampilan Berpikir Kritis Mahasiswa Melalui Kegiatan Pendampingan Penulisan Gagasan Pada Artikel. *ESTUNGKARA: Jurnal Pengabdian Masyarakat*, 2(1).
- Jamun, Y. M. (2018). Dampak Teknologi Terhadap Pendidikan. *Jurnal Pendidikan Dan Kebudayaan Missio*, 10(1), 48–52.
- Jana, P., & Fahmawati, A. A. N. (2020). Model Discovery Learning Untuk Meningkatkan Kemampuan Pemecahan Masalah. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 9(1), 213. <https://doi.org/10.24127/ajpm.v9i1.2157>

- Juniarso, T. (2020). Model Discovery Learning Terhadap Kemampuan Berpikir Kreatif Mahasiswa. *ELSE (Elementary School Education Journal)*, 4(1), 36–43. <https://doi.org/10.30651/else.v4i1.4197>
- Nahdi, D. S., & Apriadi, F. (2015). Pengaruh Model Discovery Learning Terhadap kemampuan Berpikir Kreatif Siswa Pada Matapelajaran Ilmu Pengetahuan Alam. *Jurnal Cakrawala Pendas*, 1(2), 66–71.
- Ningsyih, S., Junaidi, E., & Idrus, A. S. W. (2016). Pengaruh Pembelajaran Praktikum Berbasis Inkuiri Terbimbing Terhadap Kemampuan Berpikir Kritis Dan Hasil Belajar Kimia Siswa. *J. Pijar MIPA*, 11(1), 55–59.
- Nugrahaeni, A., Redhana, I. W., & Made Arya Kartawan, I. (2017). Penerapan Model Pembelajaran Discovery Learning Untuk Meningkatkan Kemampuan Berpikir Kritis dan Hasil Belajar Kimia. *Jurnal Pendidikan Kimia Indonesia*, 1(1).
- Nurfajriani, Hajar, S., & Nur Halimah. (2020). Pengaruh Multimedia Articulate Storyline berbasis Discovery Learning Terhadap Kemampuan Berpikir Kreatif Pada Materi Laju Reaksi. *Prosiding Seminar Nasional Kimia Berwawasan Lingkungan 2020*, 75–80.
- Nurrohmi, Y., Utaya, S., & Utomo, D. H. (2017). Pengaruh Model Pembelajaran Discovery Learning Terhadap Kemampuan Berpikir Kritis Mahasiswa. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, 2(10), 1308–1314. <http://journal.um.ac.id/index.php/jptpp/>
- Prasetyo, A. D., & Abduh, M. (2021). Peningkatan Keaktifan Belajar Siswa Melalui Model Discovery Learning Di Sekolah Dasar. *Jurnal Basicedu*, 5(4), 1717–1724. <https://doi.org/10.31004/basicedu.v5i4.991>
- Priyambudi, B., Suroya, A., Safitri, D., Susilo, H., Nathalia, & Sudrajat, K. (2019). Implementasi Model Discovery Learning Menggunakan Lesson Study untuk Meningkatkan Kemampuan Komunikasi dan Kolaborasi. *Prosiding Seminar Nasional Dan Workshop Biologi-IPA Dan Pembelajarannya Ke-4*, 629–635.
- Putra, I. G. D., Sujana, I. W., & Wiyasa, I. K. N. (2020). Hasil belajar IPS menggunakan Kolaborasi Model Discovery Learning Berbasis Media Animasi. *Journal of Education Technology*, 4(2), 103–109.
- Putri, I. S., Juliani, R., & Lestari, I. N. (2017). Pengaruh Model Pembelajaran Discovery Learning Terhadap Hasil Belajar Siswa Dan Aktivitas Siswa. *Jurnal Pendidikan Fisika*, 6(2). <http://jurnal.unimed.ac.id/2012/index.php/>
- Riduwan. (2011). *Dasar-Dasar Statistik*. Alfabeta.
- Sanova, A., Afrida, & Ekaputra, F. (2022). Pengembangan Aplikasi Platform Open Course Berorientasi PjBL Dan Case Study Berbasis Gamifikasi. *Jurnal Penelitian Pendidikan Kimia: Kajian Hasil Penelitian Pendidikan Kimia*, 9(2), 142–150.
- Sari, R. T., & Angreni, S. (2018). Penerapan Model Pembelajaran Project Based Learning (PjBL) Upaya Peningkatan Kreativitas Mahasiswa. *Varia Pendidikan*, 30(1), 79–83.
- Setyawan, R. A., & Kristanti, H. S. (2021). Keterampilan Berpikir Kritis Pada Pembelajaran IPA Melalui Model Pembelajaran Discovery Learning Bagi Siswa Sekolah Dasar. *Jurnal Basicedu*, 5(2), 1076–1082. <https://doi.org/10.31004/basicedu.v5i2.877>

Discovery Learning Based...

- Sohilait, E. (2021). Pengaruh Model Discovery Learning Terhadap Kemampuan Berpikir Kreatif Matematis Siswa. *Riemann Research of Mathematics and Mathematics Education*, 3(1), 35-41.
- Wedekaningsih, A., Koeswanti, H. D., & Giarti, S. (2019). Penerapan Model Pembelajaran Discovery Learning Untuk Meningkatkan Keterampilan Berpikir Kritis dan Hasil Belajar Matematika Peserta Didik. *Jurnal Basicedu*, 3(1). <https://jbasic.org/index.php/basicedu>