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Effectiveness of Practicum Learning With Discovery Learning Model in Improving 4C Skills of Students

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Abstract

Chemistry learning is learning that is closely related to practicum activities, so that in chemistry learning is very capable of facilitating the development of student knowledge and skills. Students' skills in collaborating in practicum activities, creativity and critical thinking skills in solving problems that are still relatively low must get serious attention in improving student skills in facing the challenges of the 21st century. The purpose of this study is to evaluate the efficacy of using the discovery learning paradigm in practicum learning to enhance 4C abilities. A total of 26 students from the Jambi University Chemistry Education Study Program who enrolled in the R-002 class inorganic chemistry practicum during the 2022–2023 academic year served as the sample for this study. This study employs an experimental design using a pretest-posttest model for a single group. A questionnaire was utilized in this study to gather information on the 4C competencies of the students. The paired samples t test was then used to evaluate the collected data. According to the study's findings, practical learning significantly improves 4C skills using a discovery learning paradigm.

Keywords: Practical Learning, Discovery Learning, 4C Skills.

1. Introduction

The development of science and technology is growing rapidly. The world of education must always implement and carry out learning activities in accordance with the times. The government's effort to keep up with the development of science and technology is to establish the independent curriculum for independent campus learning (MBKM) as a standard for organizing education in Indonesia. The MBKM curriculum is a curriculum that accommodates and refers to regulations, social dynamics, and advances in science and technology (Vhalery et al., 2022). The curriculum is an educational standard that must be adjusted to the times (Hendra et al., 2023). The development of science and technology and the application of the MBKM Curriculum as an educational standard in Indonesia, chemistry, which is one of the branches of science, has also experienced developments in the form of an active and learner-centered learning delivery system, learning models and varied assessment instruments. Direct student involvement in the learning process can increase student learning activities (Ekaputra, 2022). Learning that is able to activate students will improve their skills, so they can adapt to changing times (Ekaputra & Widarwati, 2023). Learning that involves students directly can increase their creativity (Haryanto et al., 2023). Competency improvement must be done as early as possible in order to keep up with the times and technology (Harizon & Ekaputra, 2023).

Chemistry is a science that is closely related to everyday life. Chemistry is a science that studies composition, structure, properties, changes, and the energy that accompanies them (Redhana, 2019). Chemistry learning is learning that is closely related to practicum activities, so that in chemistry learning it is very capable of facilitating the development of student knowledge and skills. Based on data in the field, it shows that students' skills in collaborating in practicum activities, creativity and critical thinking skills in solving problems are still relatively low or below 75. This is reinforced by the results of a questionnaire filled out by students who took the R-002 class inorganic chemistry practicum course in the 2022/2023 academic year of 73.3. This requires serious attention in improving student skills in facing the challenges of the 21st century.

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Lecturers as facilitators in learning activities must always innovate in delivering material so that the material is delivered in an interesting and innovative way, thus reducing the potential for learning loss of material delivered to students (Ekaputra & Sanova, 2023). Learning with a practicum model is a manifestation and strategy of learning activities that require students to use the knowledge that has been obtained from the scientific process (Windyariani, 2017). Practical learning requires collaboration and communication in solving problems encountered in learning, so that in its implementation a learning model is needed that can facilitate students in developing student skills. The 21st century skills that need to be mastered by students in facing the demands of the times include critical thinking, collaboration, creativity, and communication or more commonly known as 4C skills. The application of the discovery learning model in practicum learning is one of the efforts made by researchers to improve 4C skills.

The discovery learning model is a learning model that emphasizes active student learning activities in discovering concepts or centered on students (Rosdiana et al., 2017). The discovery learning model has the main characteristics of exploring and solving problems to combine theory; learner-centered learning, combining newly acquired knowledge with knowledge that students have previously acquired (Kristin, 2016). The discovery learning model is learner-centered, so that it can improve the ability of discovery and creativity of learners, and activate the course of learning (Yuliana, 2018).

Based on this background, the research problem focused on the application of the discovery learning model in practicum learning. The purpose of this study was to determine the effectiveness of improving 4C skills through practicum learning with the discovery learning model.

2. Literature Review

2.1. Discovery Learning

Discovery learning is a learning model where students discover information independently and actively participate in learning (Ardianto et al., 2019). The stimulation, problem definition, data collection, data processing, and verification phases are the steps in the discovery learning model's implementation of learning (Jana & Fahmawati, 2020). Some of the unique features of the discovery learning approach include its capacity to help students solve problems and gain information, to involve them directly, and to integrate newly learned material with previously acquired knowledge (Prasetyo & Abduh, 2021).

2.2. 4C Skills

4C skills are 21st century skills consisting of critical thinking, communication, creativity, and collaboration skills (Ekaputra, 2024). 4C skills are skills that are very necessary to be able to adapt to changing times (Ardiansyah et al., 2022). The MBKM curriculum facilitates the improvement of 4C skills, so that the competence of graduates can increase (Ekaputra, 2023).

3. Research Methods

This study employs an experimental design using a pretest-posttest model for a single group. A total of 26 students from the Universitas Jambi Chemistry Education Study Program who enrolled in the R-002 class inorganic chemistry practicum during the 2022/2023 academic year served as the sample for this study. The use of the discovery learning model is the study's independent variable, while 4C skills are its dependent variable. A questionnaire was utilized in this study to gather information on the 4C competencies of the students. Students completed a 4C skills questionnaire to determine their first 4C skills prior to conducting practicum activities. To make sure that the initial 4C skills data were normally distributed, the questionnaire results from the sample class were examined for normality. Activities for the inorganic chemistry practicum were conducted across four meetings. The study employed a paired samples t test as a hypothesis test to ascertain whether the inorganic practicum activities had an impact on students' 4C competencies. There is a significant gain in 4C skills in this study if the results of the hypothesis test reveal a significance value of less than 0.05.

4. Results and Discussion

The purpose of the study was to determine the effectiveness of improving 4C skills through practicum learning with a discovery learning model. Students filled out the 4C skills questionnaire given by the researcher before taking the anoragnic practicum lecture to determine the initial 4C skills. The results of students' initial 4C skills can be seen in Table 1.

Table 1. Initial 4C Skills

Indicator	Score
Critical Thinking	74.3
Collaboration	72.8
Creativity	73.5
Communication	72.4
Average	73.3

The results of students' initial 4C skills in Table 1 show that students' initial 4C skills are still relatively low with an average score of 73.3. Data regarding students' initial 4C skills in the sample class will then be tested for normality to test the initial 4C skills data obtained are normally distributed or have the same initial ability to 4C skills. Based on the results of the normality test that has been carried out, the results of the significance test value are 0.200. The normality test results obtained regarding students' 4C skills show greater than 0.05, indicating that the data in the sample class is normally distributed.

Students use what they learn and discuss to solve problems in the discovery learning model, which is a discovery-based learning approach. By using the discovery learning paradigm, students develop their critical thinking and creative thinking skills, which they can then use to communicate and work in groups to solve problems. Discovery learning is a learning model that activates students to conduct simple experiments (Putra et al., 2020). The application of the discovery learning model is very suitable for practicum courses, because it is learner-centered and facilitates students in developing critical thinking skills. Practicum-based learning models are able to develop students' critical thinking skills (Royani et al., 2018).

Learning with a practicum model provides a broad opportunity for students to explore their potential in solving problems during the experiment. Practical activities provide opportunities for students to practice applying a theory in a real situation (Kurniawati et al., 2015). Practical activities provide students to test and apply existing theories (Suryaningsih, 2017). Learning that involves students directly can improve student understanding and skills, and make learning meaningful. Meaningful learning activities are learning that is able to prioritize student activeness, integrate critical thinking skills, creativity, and have skills in analyzing a problem, have innovation to solve it (Sanova et al., 2022).

At the end of the fourth meeting with the application of the discovery learning model of practicum method, the researcher again gave a questionnaire filled in by students to obtain the final 4C skills data. Based on the results of the questionnaire regarding 4C skills filled in by students, it shows an increase in 4C skills of students who take lectures in inorganic practicum courses after being given the application of the discovery learning learning model. The results of students' 4C skills before and after the application of the discovery learning model can be seen in Table 2.

Table 2. 4C Skills Results

Indicator	Initial Value	Final Value	Gain Score
Critical Thinking	74.3	86.4	12.1
Collaboration	72.8	86.8	14.0
Creativity	73.5	88.3	14.8
Communication	72.4	86.6	14.2
Average	73.3	87.0	13.8

The final 4C skill value obtained was 87.0 or an increase of 13.8, the increase in 4C skill value was a significant increase as shown by the results of the paired samples t test using the SPSS application with the acquisition of a significance value of 0.00 or less than 0.05. The increase in students' 4C skills after the application of the discovery learning model is in accordance with research conducted by Nurrohmi et al. (2017) and Wedekaningsih et al. (2019) which stated that the application of the discovery learning model in learning activities can improve students' critical thinking skills. The increase in students' critical thinking skills is due to the discovery learning model being able to

facilitate students in building knowledge concepts independently so that learning becomes more meaningful (Prasetyo & Kristin, 2020). The application of the discovery learning model in this study was also able to improve collaboration between students both in one practicum research group and between groups. The occurrence of increased collaboration between students with the application of the discovery learning model is in accordance with research conducted by (Syafii, 2022) which states that the application of the discovery learning model can improve students' collaboration skills. The discovery learning learning model facilitates students to discuss and solve problems faced together (Priyambudi et al., 2019).

Student creativity is needed in learning with the discovery learning model, because the discovery learning model requires students' ability to solve the problems faced. The increase in student creativity after the application of the discovery learning model is in accordance with research conducted by Juniarso (2020) andFerawati & Suhendri (2020) which states that the discovery learning model is effective in increasing student creativity. The application of the discovery learning model in learning activities can help students develop their creativity to solve problems in learning (Sohilait, 2021). The discovery learning model in this study was also able to show an increase in students' communication in solving problems. Students need good communication in solving problems with their practicum group members when applying the discovery learning model, good communication with fellow group members makes success in learning greater. The improvement of communication skills with the application of the discovery learning model is in accordance with research conducted by Maulida et al. (2018) and Qodariyah & Hendriana (2015) which states that the discovery learning model can improve students' communication skills.

Thus, the study concludes that the use of the discovery learning model in practicum learning can enhance students' 4C (critical thinking, collaboration, creativity, and communication) skills. This is particularly true for students enrolled in the Universitas Jambi Chemistry Education Study Program who take the R-002 class inorganic chemistry practicum course in the 2022/2023 academic year.

5. Conclusion

The study demonstrates that implementing the discovery learning model within practicum-based courses leads to a significant enhancement of students' 4C skills—critical thinking, collaboration, creativity, and communication. This improvement was especially pronounced among students enrolled in the Inorganic Chemistry Practicum course within the Chemistry Education Study Program at Universitas Jambi during the 2022/2023 academic year. The discovery learning model employs a student-centered, inquiry-driven approach that actively engages students in the learning process. This approach promotes independent knowledge construction and encourages reflective analysis, thereby strengthening critical thinking capabilities. Moreover, the model's emphasis on collaborative activities fosters effective teamwork, allowing students to engage in collective problem-solving and idea exchange. Simultaneously, the approach cultivates creativity by encouraging students to explore diverse perspectives and innovative solutions to scientific problems. The requirement for active participation in discussions and presentations further enhances communication skills, enabling students to articulate complex ideas and engage in constructive peer dialogue. Overall, it can be concluded that in this study there is a significant increase in 4C skills through practicum learning with the discovery learning model.

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