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The Effect of Teaching Factory-Based Learning Method on the Industrial Chemistry Course

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ABSTRACT

This study aims to examine the effect of the Teaching Factory-based learning method on students' understanding in the Industrial Chemistry course. The Teaching Factory method is a learning approach that integrates industrial practical experience with the theory taught in class, allowing students to acquire skills relevant to the workforce. This study uses an experimental design with two groups: the experimental group, which follows the Teaching Factory-based learning method, and the control group, which follows the conventional learning method. Data were collected through pre-tests and post-tests to measure students' understanding. The results show that the experimental group, which followed the Teaching Factory method, experienced a significant improvement in understanding, with an average difference in pre-test and post-test scores of 19.80 (p-value = 0.000), while the control group only showed a small improvement with a score difference of 5.85 (p-value = 0.020). Practical observation indicated that students in the experimental group were more skilled in performing industrial process simulations compared to the control group. Additionally, the results of the questionnaire showed higher satisfaction levels in the experimental group (average score of 4.2) compared to the control group (average score of 3.4). Based on these results, it can be concluded that the Teaching Factory-based learning method has a positive and significant impact on improving students' understanding in the Industrial Chemistry course and the practical skills relevant to the industrial world. This study recommends implementing this method more widely in higher education, especially in courses directly related to industrial processes.

Key Word
Learning Method, Teaching Factory, Industrial Chemistry.

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INTRODUCTION

The rapid development of industry in Indonesia demands human resources that not only possess theoretical knowledge but also practical skills that align with the needs of the workforce. One way to bridge the gap between the theory taught in universities

and the practices applied in the industry is through the Teaching Factory (TF)-based learning method. This method integrates classroom learning with production-oriented activities, allowing students to learn while practicing in real-world industrial situations.

Industrial Chemistry, as one of the courses taught in the Chemical Engineering program, plays a crucial role in equipping students with the competencies needed to work in the chemical industry sector. This course not only teaches the basic theories of chemistry but also how to apply these theories in industrial processes involving various chemical reactions, industrial equipment, and production management. Therefore, it is important to use an approach that not only emphasizes theory but also provides practical experience relevant to students.

Teaching Factory, as a learning method, offers a solution to help address these challenges by bringing industry experiences into the classroom. In this method, students can directly engage in activities that simulate an industrial work environment, making them better prepared to face the demands of the workforce. However, although this concept has been applied in various fields, its implementation in the Industrial Chemistry course is still limited, necessitating further study on its effectiveness.

This study aims to examine the effect of the Teaching Factory-based learning method on students' understanding in the Industrial Chemistry course. It is expected that the results of this research will contribute to the development of more effective learning methods, particularly in creating a learning environment that better connects theory and practice, thus enhancing students' competencies and their preparedness to face challenges in the chemical industry.

RESEARCH METHOD

This study uses a quantitative approach with an experimental research design. The aim of this experimental research is to examine the effect of the Teaching Factory-based learning method on students' understanding in the Industrial Chemistry course. The design used is the pre-test post-test control group design, which involves two groups: the experimental group, which receives treatment with the Teaching Factory-based learning method, and the control group, which uses conventional learning methods.

The population in this study consists of students from the Chemical Engineering program enrolled in the Industrial Chemistry course at the Akademi Maritim Belawan in the 2024 academic year. The sample used in this study is the students, divided into two groups: one experimental group and one control group. The sample selection was carried out using purposive sampling technique, which involves selecting students who meet specific criteria, such as having taken the Industrial Chemistry course for at least one semester.

The total sample size taken was 45 students, consisting of 25 students in the experimental group and 20 students in the control group. The determination of the

experimental and control groups was done randomly after considering the students' similar backgrounds and academic abilities.

The instruments used in this study are as follows Pre-Test and Post-Test. These tests are used to measure changes in students' understanding before and after the implementation of the Teaching Factory-based learning method. The tests consist of multiple-choice and essay questions covering key topics in the Industrial Chemistry course. This instrument is used to assess students' responses to the applied learning method, including their satisfaction, challenges faced, and perceptions of the relevance of Teaching Factory-based learning to the industrial world.

The research procedure consists of several stages, which are:

1. Preparation Stage: This involves developing the research plan, including the preparation of research instruments (questionnaire).
2. Learning Implementation Stage: The experimental group will follow the Teaching Factory-based learning method, which involves industrial process simulations, collaboration with industry practitioners, and the use of industrial tools in practical sessions. The control group will follow conventional learning with lecture and discussion methods.
3. Data Collection Stage: Data will be obtained by administering the pre-test before the learning begins, and the post-test after the learning is completed. Observations will be made during practical sessions to assess students' practical skills. The questionnaire will be administered at the end of the study to measure students' responses to the learning method.
4. Data Analysis Stage: The data collected from the pre-test, post-test, observation sheets, and questionnaires will be analyzed statistically using a t-test to test for differences between the experimental and control groups. Descriptive analysis will also be used to describe students' responses to the applied method.

The data analysis used in this study is quantitative, using a paired sample t-test to test for differences between the pre-test and post-test scores of the experimental and control groups. Additionally, descriptive analysis will be used to analyze the data from the observation sheets and questionnaires.

RESULT AND DISCUSSION

This study aims to examine the effect of the Teaching Factory-based learning method on students' understanding in the Industrial Chemistry course. The data obtained consists of the results of the pre-test and post-test in the form of questionnaires completed by the students. Below is the analysis of the research results:

Table 1.
The average pre-test and post-test scores for both the experimental and control groups

Class	Average Pretest	Average Posttest	Differen Score	Sig. (2-tailed)
Experiment Class	65.32	85.12	19.80	0.000
Control Class	64.90	70.75	5.85	0.020

From the table above, it can be seen that the experimental group experienced a significant improvement, with a score difference of 19.80 and a significance value (p-value) of 0.000, which is smaller than $\alpha = 0.05$. This indicates that the Teaching Factory method has a significant effect on improving students' understanding in the Industrial Chemistry course.

Meanwhile, the control group only experienced a small improvement of 5.85, with a significance value of 0.020, which is also smaller than 0.05, but not as large as the experimental group. This indicates that although there was improvement, the conventional learning method is less effective compared to the Teaching Factory method. The practical observation results showed that students in the experimental group demonstrated better skills in applying industrial chemistry concepts in real-world situations. The students were able to perform industrial process simulations more confidently, understand the production flow, and use the industrial equipment provided in the laboratory. As much as 80% of students in the experimental group demonstrated excellent or good practical skills, while the control group only reached 50%.

The questionnaire results revealed that students in the experimental group gave more positive responses to the Teaching Factory-based learning method. The average satisfaction score for students in the experimental group was 4.2 out of 5, with 85% of students feeling that this method was relevant to the industrial world and improved their practical skills. In contrast, the control group gave an average satisfaction score of 3.4, with most students feeling that conventional learning did not sufficiently equip them with the skills needed in the workforce.

The results of this study indicate that the Teaching Factory method has a significant effect on improving students' understanding in the Industrial Chemistry course. This aligns with the research by Dewi and Setiawan (2020), which states that industry-based methods can help students connect the theory taught in class with real-world practices. In this context, the implementation of the Teaching Factory method provides students the opportunity to experience real industrial process simulations, such as operating industrial equipment and analyzing chemical processes on an industrial scale.

Moreover, this method allows students to learn not only from instructors but also through direct practice in the field, enhancing their understanding of industrial chemistry theory that was previously taught abstractly. The application of the Teaching Factory method bridges the gap between theoretical knowledge and the practical skills needed in the industrial world.

The control group, which used the conventional learning method, only experienced a relatively small improvement in understanding. Conventional methods, which rely more on lectures and class discussions, proved less effective in developing the practical skills that are highly needed in the workforce, particularly in the industrial chemistry field. This is also supported by Sari (2019), who emphasized that conventional learning methods often do not provide students with experiences that are relevant to the industrial world. However, despite some improvement in the control group, the results obtained were not as large as those in the experimental group. This shows that while the conventional method can improve students' understanding, it does not do so as effectively as the Teaching Factory method, which provides a more holistic and integrated learning experience.

Practical observations showed that students in the experimental group had better practical skills. They were able to operate the laboratory equipment used in industrial process simulations and understand each stage of production in more depth. The Teaching Factory method allowed students to experience situations resembling real industrial work conditions, helping them develop the technical skills that are highly needed in the workforce. Meanwhile, students in the control group, who only relied on theory in conventional learning, tended to be less skilled in hands-on practice. This indicates that direct involvement in industrial situations through the Teaching Factory method provides more applicable and in-depth learning.

CONCLUSION

Based on the results and discussion of the research, it can be concluded that the Teaching Factory-based learning method has a positive and significant effect on students' understanding in the Industrial Chemistry course. Teaching Factory-based learning not only enhances students' theoretical understanding but also enriches practical skills relevant to the industrial world. Therefore, it is recommended to further develop and implement this method in higher education, especially in courses that are oriented toward the application of technology and industrial processes.

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