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Analysis and Training of Innovative Learning through the Use of the Irydium Application in Basic Chemistry Practicum

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Abstract: The development of technology in education, particularly in chemistry education, demands innovation in laboratory activities to enhance their effectiveness and efficiency. One such innovation is the Irydium Application, a digital-based platform for basic chemistry practicum. This study aims to determine the effectiveness of using the Irydium Application among students of the Chemistry Education Study Program who have completed the School Field Introduction Program (Pengenalan Lapangan Persekolahan/PLP). The research began with a training session on the use of the Irydium Application prior to data collection. A descriptive qualitative method was employed, with data collected through interviews, surveys, and observations to obtain a comprehensive understanding of the changes and impacts associated with the application's use in basic chemistry practicum activities. The results show that the Irydium Application is highly needed by PLP students to support laboratory practices in schools. However, students were only introduced to this application after the training. Students also agreed that the Irydium Application is easy to install and operate, and it can significantly enhance the effectiveness of chemistry practicum activities in schools. Therefore, the integration of the Irydium Application can serve as an innovative and technology-based approach to improving chemistry learning and practicum experiences.

Keywords: iridium application; basic chemistry practicum; school field introduction program

INTRODUCTION

Chemistry labs are a crucial element in science learning because they connect theoretical concepts with real-world applications in the laboratory. Chang and Goldsby (2016) stated that labs help deepen understanding of basic chemistry concepts through systematic experimentation.

The transformation of chemistry laboratories toward the integration of modern technology opens up opportunities for more interactive, safe, and accessible learning. Technological advancements in education, particularly chemistry education, demand innovation in practical activities to make them more effective and efficient. Therefore, this research is crucial in discussing the

development of chemistry laboratory applications and their implications for learning in the digital age.

One such innovation is the use of the Irydium Application, a digital-based application for basic chemistry labs. This study aims to determine the effectiveness of using the Irydium Application among Chemistry Education students who have completed the PLP. This application can be installed on a computer or laptop. However, the Irydium Application remains underutilized, and some people are unfamiliar with it. One of the main reasons is limited access to hardware and a stable internet connection.

Research on Irydium applications is very limited in Indonesia, for example, the undergraduate thesis by Andriawati (2025). This study is about the application of inquiry learning assisted by the Irydium Chemistry Lab to develop students' higher-order thinking skills in the material of solution stoichiometry. Several other studies on the use of Irydium applications are only found in central and western Indonesia, while on the island of Papua has not been touched at all. Therefore, researchers are interested in conducting training and analysis of the use of this application in Papua, especially in Manokwari, West Papua.

LITERATURE REVIEW

According to Hofstein and Lunetta (2004), well-designed labs can improve science process skills, such as observation, measurement, and data analysis, while also developing scientific attitudes such as accuracy, objectivity, and responsibility. They also emphasize that laboratories are an important tool in inquiry-based learning, where students play an active role in designing and implementing experiments. As technology advances, laboratory methods have undergone significant transformations.

Sudjana (2017) added that practicums are not just a means of practicing technical skills, but also a medium for developing 21st-

century competencies such as collaboration, problem-solving, and digital literacy. Therefore, chemistry practicum applications that integrate theory, laboratory skills, and modern technology are highly relevant to supporting learning that adapts to current developments.

Kuhl (2016) states that the use of modern equipment such as digital sensors, data logging devices, and virtual laboratories (VL) can improve the accuracy, efficiency, and safety of laboratory work. This technology also enables remote laboratory work, expanding student access to experimental-based learning.

A quasi-experimental study by Kanwal et al. (2021) at the secondary level showed that the use of VL significantly improved students' academic achievement at the levels of understanding and application. Furthermore, a meta-analysis by Reyes et al. (2024) confirmed that VL offer benefits in terms of accessibility, flexibility, and active learning when integrated constructively into the curriculum.

A quasi-experimental study by Bazie et al. (2024) showed that VL provided academic outcomes in chemistry labs equivalent to those in real laboratories, with significant improvements compared to lecture-only methods. These findings demonstrate the potential of VL as a flexible, safe, and effective experimental learning support system.

The use of VL is a significant innovation in chemistry education. Chan et al. (2021) identified that VL provides flexibility in time and location, reduces operational costs, and improves learning safety. Furthermore, the integration of technologies such as smartphones into digital image colorimetry has enabled inexpensive, accessible, and applicable chemical analysis, as explained by James and Honeychurch (2024).

One application of virtual labs, namely the maker education approach, utilizing low-cost devices such as Arduino, is also

beginning to be integrated into chemistry lab curricula. Tay and Eng (2024) demonstrated that the use of an Arduino-based autotitrator not only teaches titration concepts but also improves students' technical skills and creativity. Similarly, the use of virtual reality (VR)-based laboratories is considered effective in increasing student engagement and understanding of difficult-to-visualize concepts (Guruloo & Osman, 2023).

One example of VL is the use of the Irydium application. The Irydium application is a digital-based application for basic chemistry labs. Research by Andriawati (2025) states that the application of inquiry-based learning using the Irydium Chemistry Lab can develop students' higher-order thinking skills in the topic of solution stoichiometry.

Puspasari (2023) stated that the problem-based learning model assisted by Irydium Chem Lab Media has a positive effect on the critical thinking skills and learning outcomes of grade xi students of SMAN 5 surakarta on buffer solution material. There is also research by Uzani, et al. (2023) on the development of a virtual practical module based on critical thinking skills on acid-base material. The module developed uses the Irydium application, which is feasible and practical so that it can be used in the learning process.

METHODS

A. Location and Time of Research

This research was conducted in the Chemistry Education Study Program, Faculty of Teacher Training and Education (FKIP), University of Papua (UNIPA). The population and sample/information were Chemistry Education students in the FKIP UNIPA Chemistry Education Study Program who had participated in internship programs. Eight students participated in the training: two from the 2018 intake, one from the 2019 intake, three from the 2020 intake, and two from the 2021 intake. Data

collection took place from April to July 2025.

B. Research Procedure

The research procedure began with a preparatory stage, including selecting the Irydium application to be used in the Basic Chemistry practical training, developing research instruments such as questionnaires and observation sheets, and testing the validity and reliability of the instruments. Following the training and practical training, data were collected through questionnaires to measure student perceptions, as well as observations and interviews to enrich information related to the application's user experience. Quantitative data were analyzed descriptively, while qualitative data were analyzed thematically. The results of the study will be used to evaluate the effectiveness and student satisfaction with the use of the virtual laboratory application.

C. Data Collection Techniques

The data collection techniques used in this study include:

1. Interviews: Semi-structured interviews with students and lecturers to gather information about their experiences using the Irydium Application, their understanding of the application, and the challenges and benefits they experienced.
2. Survey: Use of questionnaires or surveys to measure students' perceptions and satisfaction with the Irydium App, as well as its impact on their understanding of basic chemistry material.
3. Observation: Conduct direct observations of labs using the app, documenting how students interact with the app and how it is used in teaching and learning contexts.

D. Data Analysis Techniqyue

The data analysis technique used in this study was thematic analysis for qualitative data obtained from interviews and observations. The steps for qualitative data analysis are:

1. Transcription and Coding: Interview and observation results were transcribed, then the collected data was coded to identify key themes related to the use of the Irydium application.
2. Thematic Analysis: The coded data was grouped into relevant themes, such as challenges, benefits, ease of use, and the application's impact on students' understanding of chemistry concepts. For survey data, descriptive statistical analysis was used to measure the frequency and percentage of student responses regarding application use, as well as their satisfaction with and perceptions of the application.

RESULT AND DISCUSSION

The survey or questionnaire in this study aimed to determine satisfaction with the use of the Irydium Application. The questionnaire results were as follows:

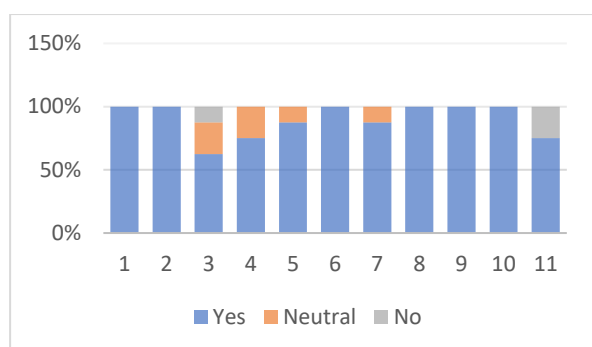


Figure 1. The analysis results of the Irydium Application usage

The Figure 1. can be explained as follows:

1. All respondents, or 100%, only learned that chemistry labs can be conducted digitally or through an app. They learned this after the training.
2. There are 100% only learned about the Irydium Application. Respondents only learned about the application after the training.
3. There are 62.5% of respondents agreed that the Irydium Application was easy to install, 25% were neutral, and the rest found it difficult to install. Respondents

experienced several challenges, including limited internet connection and the need for a laptop that supports the Java Platform. If not, Java must be downloaded and installed first.

4. There are 75% of respondents who agree that the Irydium Application is easy to use and the others answered neutrally.
5. There are 87.5% of respondents agreed that the Irydium App can facilitate basic chemistry labs, and 12.5% responded neutral.
6. There are 100% of respondents agreed that the Irydium App can improve the effectiveness of basic chemistry labs.
7. There are 87.5% agreed that the Irydium App can be used anytime and anywhere, and 12.5% neutral.
8. There are 100% of respondents enjoyed using the Irydium App.
9. There are 100% of respondents agreed that the Irydium Chemistry Lab can be used in junior high and high schools to support chemistry labs, especially for schools with limited laboratories, equipment, and materials.
10. There are 100% of respondents agreed that similar chemistry lab applications would be useful.
11. There are 75% of schools where School Field Introduction students are interns do not have lab/laboratory space.

Based on the survey results above, it shows that all UNIPA chemistry education students who have completed their internships only learned that basic chemistry practicums can be conducted using the Irydium application. This application significantly improves the effectiveness of the practicums. This application should be introduced before they begin their internships. This is because in reality, some schools still experience limited space, equipment, and materials for conducting basic practicums. However, this application will be very helpful when they return to serve as teachers in their schools.

The data of user satisfaction levels for the Irydium Application are as follows:

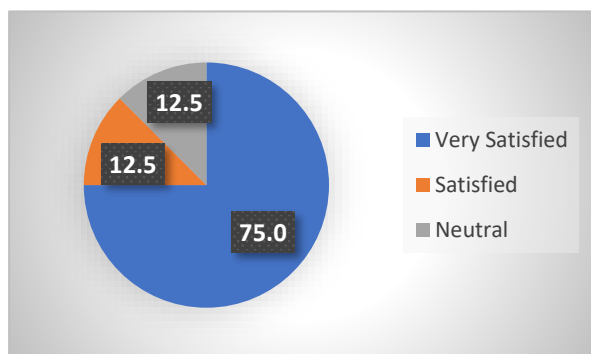


Figure 2. User satisfaction levels for the Irydium Application

The results of the analysis application usage indicate that 87.5 % of user are satisfied or very satisfied, showing a strong positive response to the application's performance and features. Only 12.5% of users reported neutral, suggesting that the app meets user expectations effectively, though minor improvements may still be needed in usability and interface design.

In this study, in addition to survey analysis, interviews and direct observations were also conducted with students who had completed their internships. This step aimed to strengthen the research data and provide a more holistic understanding of the results. The findings from the interviews and observations are as follows:

1. Obstacles to Practical Work

According to interviews, it was discovered that some schools have very limited or even no practical work at all in basic chemistry labs. Practical work is typically conducted using only the materials and equipment available. If equipment and materials are missing, they are usually replaced by watching practical videos.

2. Application Use in Chemistry Labs

The use of applications in chemistry courses at UNIPA is already widespread.

However, applications have never been used in basic chemistry labs. Therefore, introducing the Irydium Application will be very helpful when they become teachers.

CONCLUSION

Based on the research results, it can be concluded that the use of the Irydium Application has high potential to increase the effectiveness of basic chemistry practicums, especially for Chemistry Education students participating in School Field Introduction (PLP) activities. This application has proven to be easy to use, efficient, and able to help students understand chemical concepts more interactively and contextually.

Implicitly, the results of this study indicate that integrating digital technology such as the Irydium Application into practicum activities can be a solution to the limited laboratory facilities in schools. This opens up opportunities for educators to develop digital-based practicum learning models that are more flexible and adaptable to current developments.

In terms of its contribution to science, this research provides an empirical basis for developing innovations in technology-based chemistry learning, particularly in the simulation and visualization of abstract chemical concepts. Furthermore, these findings can enrich the literature on digital transformation in science education and serve as a reference for further research in the development of chemistry learning media and educational technology.

Thus, the use of the Irydium Application not only contributes to improving the quality of basic chemistry learning and practicums but also strengthens the position of technology as an integral part of the development of science and science education in the digital era.

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