

## Evaluation of Student Ability through Independent Inorganic Chemistry Practicum Project During Pandemic Period

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### Abstrak

Practicum was a subject that was applicable to theory. In inorganic chemistry practicum, students were trained to apply concepts through independent experiments. This experiment was motivated by several obstacles, including: difficulty in materials and practicum tools, practicum waste management, and facilities availability. This obstacle was challenged by opportunities in the form of using tools and materials, the used of digital technology, and the space for student creativity. Therefore, the design of an inorganic practicum was an independent practicum that starts with preparing a project, did the experiments to communicating the output. The research method was objective-oriented evaluative. The research sample was the fifth semester students of the chemistry education study program, FKIP, Nusa Nipa University. Data collecting was by interviews, observations, and questionnaires. Data was analysed in descriptively and quantitatively. The results showed that the average ability of students in preparing projects, implementing, and communicating practicum results was 87.50%; 83.77% and 89.58%. The average ability was classified as good, which was indicated by the creativity in creating practicum, using materials in everyday life and utilizing digital technology in creating practical outputs.

**Keywords:** Evaluate the ability; Free practicum; Inorganic chemistry; Pandemic.

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## INTRODUCTION

The world and Indonesia especially at this time are experiencing a disaster that has a direct impact on all sectors of life. WHO statement in 2020 that the spread of corona virus is so fast and it's an impact with Indonesian (Yanuarita & Sri, 2021). The contribution of news in various media can have a positive or negative impact on the academic world. On the bright side, the media is a source of information that reports on all developments both about the situation during the pandemic until finally the findings of scientists in contributing their knowledge. On the other hand, there is news that also disturbs human psychology.

The Indonesian government in dealing with the corona pandemic disaster has made many innovations, especially in the field of education. The new normal situation gave birth to the idea of an independent campus for campus residents, one of which is the independent learning program for an independent campus. The role of students as independent students is required to innovate and make good friends with information technology. Educational components in all sectors will adapt in managing learning. In principle, learning will continue with changes in teaching and learning strategies. Lecturers have to able applied the learning innovation uses learning media bases digital (Susanty, 2020).

In its development, the learning process underwent a change in method due to the impact of the pandemic. Winata, dkk (2021) say that the learning system that was originally face-to-face was later changed to blended learning and finally to the BDR pattern (learning from home). Some of online learning media can be used are whatsapp group, google suite for education, ruang guru, zenius, and zoom (Atsani, 2020). This change in learning patterns triggers a struggle in the learning mechanism. This affects lectures both theoretically and practically. Lecturers as subject teachers are required by circumstances to be skilled in designing effective lecture strategies.

Chemistry education as a part of all education has given positive and negative impact to our life. The positive impact is to build up concept and chemistry knowledge application through practicum. On the contrary, the negative impact is the application of principal of chemistry that is not care to environment (Idrus, dkk., 2020).

Practicum is one of the required courses to complete students' basic abilities in chemistry.

Prospective chemistry teacher students are required to have skills other than chemistry knowledge. Windyariani's opinion (2017) about practicum is a strategy as well as a manifestation in the learning process that forces students to use their scientific knowledge. The character of science learning cannot be separated from inquiry activities in experiments.

Involvement in the world of work requires students to have intellectual intelligence and basic abilities. There are three basic abilities, including knowledge, skills and attitudes (Maknum, 2015). In these three elements, knowledge can be obtained theoretically, attitudes through learning at any time. The skill element will be seen if there is a process of practicum. Through the practicum process, knowledge can be applied through both simple experiments and more complex experiments.

The practicum concept adopted by the open university is that practicum can be done anywhere, either in the classroom, laboratory or in the field (Sadjati & Pepi, 2013). In addition to the practicum concept pioneered by the Open University, there is a practicum innovation called microscience experience (Silawati, 2006). The term means science practicum carried out on a small scale. The advantages of this concept are small-scale equipment, minimal need for practicum materials, practicum tools that can be used repeatedly; practicums can be carried out at home, safe and do not damage the environment. The practical form of the microscience experience practicum concept is the manufacture of a microchemistry kit. This practice has been implemented in a large country such as South Africa and the results have had a good effect on understanding the concept of chemistry.

Amahoroe, Arifin & Solihin (2020) put forward the concept of a STEM-based practicum. Practicum can be designed in such a way that students' science, technology, engineering and math skills can be developed. The advantages of STEM are involving technology in practical learning, training students to solve problems in real life, designing new things and innovating according to the progress of the times, understanding the environment and the existence of the universe, thinking and acting logically in formulating a conclusion..

The collaboration of the common threads of these practicum concepts greatly supports the elaboration of independent practicum projects where students can explore these abilities by utilizing technology. Independent practicum can

hone students' abilities that may not have been maximized before. Practicum is synonymous with application, analysis, synthesis and evaluation skills. Margunayasa & Putu (2014) have given an opinion that the kinds of practicum are exercise practicum, experience practicum, and investigation practicum. The third of that practicum is recommended for students. This scientific ability can only be achieved if given space and time as well as opportunities for students to find the concept of knowledge. Through the concept of guided free experimentation, students have the opportunity and potential to prove the truth of a concept of knowledge and even discover new knowledge based on the analysis of previous knowledge. This Process is known as discovery learning. Students will get experience independently and criticize (Nanangkong, Rymond, & Djefry, 2019). On the other hand, the practicum design prepared by the lecturer can kill the creativity and freedom of students in determining and determining the experimental design. Lecturers need to provide direction on practicum themes so that student practicums are not outside the limits of knowledge. Furthermore, students will develop their own experimental references.

Inorganic chemistry practicum is a course that trains students' skills and tests knowledge. So far, the implementation of practicum is often an obstacle at the study program level. The constraints in question, among others: difficulty in bringing in materials and practicum tools, management of practicum waste, availability of suggestions for adequate laboratory facilities. The same thing is experienced by Silawati (2006) in the discussion of her article. The information on the obstacles presented was the need for a large budget for science practicum, large equipment facilities such as fume hoods, storage of glassware and chemicals, and the need for special laboratory personnel for handling labs and hazardous waste.

Based on the problems faced, namely the existence of a pandemic disaster and field obstacles in carrying out practicums, the solution that can be taken is to carry out independent practicum projects. The advantage of this innovation is to overcome these problems and provide creative space for students in utilizing today's learning technology according to the situation and advances in science and technology. With independent practicum activities, students will practice life skills in planning, interpreting, processing and concluding an object in life. This

practicum will direct students in fostering an attitude of life towards scientific matters.

The definition of independent practicum design in this study is to apply inorganic chemistry theory where students carry out independent practicums to deliver the outputs of practicum projects. Students are given the freedom to browse the practicum guides and even modify them, carry out practicums with no space and time limitations and report the results using modern technology features. The existence of practicum innovation by utilizing materials in the environment around the house, researchers can evaluate several things that are the objectives of this research, including: components of practicum instructions, practicum implementation and practicum project outcomes.

Similar research is an independent practicum evaluation at an open university. The results of the study stated that there was a positive perception of students towards practicum activities (Susilo., et al, 2015, p.59) although with some obstacles such as access to practicum guides, tools and materials. The limitations of this study become a complete reference for the design of inorganic chemistry practicums.

## METHOD

This type of research design uses an evaluative approach, evaluation methods with models in particular, goal-oriented evaluation or goal-oriented evaluation (Eprianti, Herpratiwi, & Sulton, 2014). The mechanism for a similar approach is described by Novalinda, Ambyar & Rizal (2020), including: formulating goals, classifying goals, formulating goals in measurable terms, determining goal achievement, developing methods, collecting data and making data analogies.

The object of research is the fifth semester students of the Chemistry Education Study Program, FKIP University of Nusa Nipa. The reason for choosing the sample is that students are taking inorganic chemistry practicum courses during the research.

Data collection techniques used a variety of interviews, observations, and questionnaires. The interview in question is an open interview with 30 students of Semester V and students of the previous generation to evaluate the practicum method. Observations are direct on experiments conducted by students with adjusted time and place conditions. The questionnaire is in the form of a self-assessment which is specifically directed

at evaluating the performance of each individual practicum.

The assessment instrument refers to data collection techniques, namely using interview sheets, observation sheets and self-assessment questionnaires. The indicators on the observation sheet and questionnaire instruments are made in the same grid, which contains three stages of assessment, including: preparation, implementation and practicum evaluation. The assessment reference uses a scale of 4, according to Table 1.

**Table 1. Rating Scale Criteria**

No.	Criteria	Score
1.	Very good	4
2.	Good	3
3.	Enough	2
4.	Not good	1

#### Data analysis

Data analysis used quantitative descriptive techniques. Quantitative data is obtained through calculating the percentage of student achievement. How to calculate the percentage technique, as follows.

$$\bar{x} = \frac{\text{Skor empiris}}{\text{Skor maksimal}} \times 100\%$$

Information:

x = average percentage of  
assessment achievement

Empirical score = score achieved by individual

Max score = maximum achievement (scale 4)

## RESULTS AND DISCUSSION

This study aims to determine the ability of students in the application of inorganic chemistry knowledge through independent practicum. The indicators that characterize student competencies are divided into three parts, including: the ability to make practical guides, carry out practicums and create practical outcomes. The results shown in Table 2 are students' abilities in creating practical guides.

**Table 2. Practical Guide**

No.	Indicator	Average (%)
1.	Practical ideas obtained by yourself	58,33
2.	There is curiosity about practical material	75,00
3.	Practical instructions are obtained through the internet site	97,92
4.	Modify the practical instructions according to the situation and conditions	100,00
5.	Loading inorganic chemical science content	93,75
6.	Selection of simple and motivating practicum themes	100,00
Average percentage		87,50

The data in Table 2 illustrates that there are six abilities in making practical guides independently. All students choose simple and motivating practicum topics to learn inorganic chemistry. One of the interesting topics is the identification of the element carbon in hydrocarbon compounds using materials such as rock sugar ( $C_6H_{12}O_6$ ). Most of the students adopted the practicum instructions through the internet site and modified them according to the situation and conditions. With the direction in this independent practicum design, 93.75% of students conduct practical work on inorganic chemistry where the material is obtained through lecture theory in inorganic chemistry courses.

The results of the practical implementation measured on 19 indicators are in Table 3.

**Table 3. Practicum Implementation**

No.	Indicator	Average (%)
1.	Creativity in using practical tools	95,83
2.	Creativity in the use of practical materials	95,83
3.	The accuracy of the use of practical tools	93,75
4.	The accuracy of the use of practical materials	95,83
5.	Use of practical tools in everyday life	100,00
6.	Ease of obtaining practical tools and materials	100,00
7.	Use of practical materials in everyday life	100,00

8.	Practical implementation according to the situation and conditions (guided)	100,00
9.	Ability to plan motivating experiments	95,83
10.	Analyzing the hypothesis	58,33
11.	Carry out practicum systematically and procedurally	83,33
12.	Ability to explain practical phenomena	81,25
13.	Ability to convey data on practical results	79,17
14.	Practical data is clear, complete and accurate	79,17
15.	Ability to analyze practical results	77,08
16.	Ability to discuss according to data	77,08
17.	Summing up properly	79,17
18.	Tidy up tools and materials	50,00
19.	Provide challenge hypotheses/problems for further analysis	50,00
Average percentage		83,77

The practicum implementation indicators in Table 3 describe scientific ability. Through this independent practicum, it was observed that creativity, accuracy, utilization, ease of obtaining materials and tools in daily life are very prominent. This proves that chemistry by and for life. In the practice of recrystallizing table salt using coconut shell charcoal. In accordance with the surrounding land conditions, coconut shell materials are widely available in the environment. The optimization of the materials greatly supports the insight of the scientific benefits. Practicum is also carried out in the home environment can provide insight into the knowledge of the community about materials around life.

The other practicum themes carried out by students were making acid-base indicators using purple sweet potato extract and red spinach. So far, practicum with this theme has been faced with obstacles in the form of the absence of acid-base reagents such as HCl and NaOH. In this practicum, students replace the two acid-base reagents using a solution of orange and soap. Tiak, Djefri, & Joyce, 2019) suggest that practicum by utilizing natural materials provides an opportunity for teachers to develop in

processing thinking skills and see the environment as inspiration as lesson material in class. The experiments carried out greatly motivate student teacher candidates to transfer knowledge and experience to students later.

Other results are in Table 3, namely the ability to communicate results with explanations of phenomena, data, results and recommendations with a percentage range of 77.08 to 81.25%. These results can be said that students' communication skills are classified as good. However, on the other hand the lowest percentage on the ability of the hypothesis (50%). This deficiency is due to the fact that students are not used to building a concept or hypothesis based on the problem. These results will focus attention on future learning by training in formulating hypotheses and analytical skills.

Other student competencies in Table 4 are related to creating practicum outcomes.

**Table 4. Practical Outcomes**

No.	Indicator	Average (%)
1.	External variations	85,42
2.	Information suitability	75,00
3.	Use of ICT	93,75
4.	Detailed and clear delivery	81,25
5.	Complete and systematic information	85,42
6.	Language use	100,00
7.	Attractive and informative packaging	97,92
8.	Outward originality	100,00
9.	Process explanation	83,33
10.	Explanation of inorganic chemistry applications	83,33
11.	Collection discipline	100,00
Average percentage		89,58

The results in Table 4 show that all indicators related to external creativity are very good with an average percentage of 89.58%. The production of practical outputs has involved digitalization technology according to the latest learning era. The output is packaged with animated interactive videos to make it easier to understand the procedures and experimental results. Originality is measurable with the output made by each individual. The inorganic chemical content in the output is in the range of 83.33%.



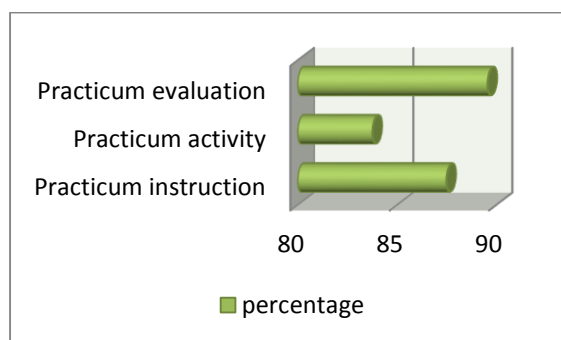
Almost all projects are related to the application of inorganic chemistry in daily life.

Hendriyani & Randi (2020) in their research on the outcomes of independent practicums during the covid period, which has a positive effect on developing creativity and oral communication skills. This is in line with the era of digital-based learning. In particular, the measure of creativity is seen from the fluency of thinking, flexibility of thinking, elaboration and originality, while oral communication skills are based on the use of language, mastery of content, techniques and speaking skills.

Saraswati & Mertayasa (2020) revealed that there are three practicum stages at the tertiary level, including pre practicum, practicum core and post practicum. This stage is in line with the design of the independent practicum process in this study. This formula is considered not only to measure cognitive skills but also to hone technical skills. The pandemic situation limits normal implementation, so this is done by using technology and online media.

Sholikah., et al (2020) in their research observed the ongoing practicum activities during the pandemic. The result is that the practicum is still carried out with the concept of simple experiments using tools and materials in everyday life.

The overall picture of student abilities in independent practicum can be seen in Figure 1.



**Figure 1. Percentage of Student Ability in Independent Practicum**

The summary of the results shown in Figure 2 shows that the indicator of student ability in independent practicum with a very good average exceeds 80%. These abilities include: determining the topic of the practicum, carrying out the practicum and evaluating the practicum. These three abilities, the lowest percentage in the implementation of practicum caused by the

ability to hold a hypothesis which is minimal by almost all students. This becomes an evaluation note for both inorganic and other practicums. Making a hypothesis is an ability that requires high analytical reasoning. This ability should already be owned at the student level but has not been optimized. On the other hand, the highest percentage is in the practicum evaluation section where the practicum outputs are packaged in the form of practicum reports and practicum video summaries. Students are very skilled in reporting results and creating creative content on practicum videos.

So, the independent practicum has a big advantage in giving students creativity and motivation to get inorganic chemistry. This strategy is intended to fulfill the lack of a previous practicum, such Eliyarti & Chichi (2019) say. They say that it needs to improve the student motivation to study in running the basic chemistry practicum so that the lecturers take more the practicum instruction.

## CONCLUSION

Based on the results of this study, it can be concluded that the average ability of students in independent practicums is classified as good in terms of practicum planning elements (87.50%), practicum implementation (83.77%) and communicating practicum results (89.58%). Independent practicum is a solution to various problems of practicum implementation such as constraints on tools, materials, places and practicum situations. The recommendation from the results of the practicum is that the ability is classified as good in creating practicum content, processes and outcomes. Creativity and applicability of inorganic chemistry theory is applied properly through independent practicum.

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