

Students' Perceptions on the Implementation of Natural Product Chemistry
Laboratory Using *Sasambo* Medicinal Plants

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Abstract

This research described the implementation of the natural product chemistry laboratory using *Sasambo* medicinal plants (*Sasak*, *Samawa*, *Mbojo*, indigenous tribes of Nusa Tenggara Barat Province, Indonesia). It revealed students' perceptions of laboratory activities. The use of *Sasambo* medicinal plants in laboratory activities is carried out because it is very close to students' daily lives. This research method was descriptive qualitative obtained from observation, documentation, interview, and questionnaire techniques. Respondents consisted of 59 third-year students from the Department of Chemistry Education at one of the state universities in Nusa Tenggara Barat, Indonesia, during the second semester of the 2020/2021 academic year. This laboratory activity begins with giving a laboratory project to students. The team determined the *Sasambo* medicinal plant species used in this laboratory based on the results of the previous isolation. The selection of the *Sasambo* medicinal plant species took into account the difficulty level of isolation of its secondary metabolite compounds. The results showed that the planning of the natural product chemistry Laboratory using *Sasambo* medicinal plants was in a good category. The facilities and infrastructure used were complete and proper, the learning resources used were apt and up-to-date, and the implementation of the activities was in the good, interesting, and disciplined category.

Keywords: Chemistry Laboratory, Natural Product, Perception, Students, *Sasambo*

INTRODUCTION

Natural product chemistry laboratory using *Sasambo* medicinal plants (*Sasak*, *Samawa*, *Mbojo*, indigenous tribes of Nusa Tenggara Barat Province, Indonesia) has a uniqueness that is different from other natural product chemistry laboratory (Hakim, et al., 2016; Nazri, et al., 2012; Carroll, et al., 2012; Walsh, et al., 2012; Halpin, et al., 2010; Douglas, et al., 2007). *Sasambo* medicinal plants are very close to students' daily lives in the province of West Nusa Tenggara. It will be able to open up opportunities for meaningful learning.

Natural product chemistry examines secondary metabolites contained in an organism. The natural product chemistry laboratory has given opportunities to students to follow a process, observe, analyze, prove, and draw conclusions, and cultivate a rational way of thinking (Hakim et al., 2020). The core of the natural product chemistry laboratory is the isolation of secondary metabolites from various plant species. Laboratory activities require effective management by optimizing various components so that the learning process can run according to plans and goals to be achieved.

A natural product chemistry laboratory requires proper management and optimally involves the components

(Hakim et al., 2016). These components may include administration, the presence of laboratory assistants, activity planning, implementation of laboratory activities, laboratory models, assessment systems, and other components (Cahyawati, 2010). The harmony of the relationship between the lecturer and the students and the high level of cooperation between the students will occur in the form of interaction (Yunita, 2017).

Since the Covid-19 outbreak, higher education learning has been implemented online (Haryadi et al., 2021; Saputra et al., 2021; Hermawan, 2021). Implementing the natural product chemistry laboratory at one of the universities in the Nusa Tenggara Barat was carried out based on the covid 19 protocol. The laboratory was carried out with a limited number of students. So that the laboratory was carried out in turns for each group. This change impacts the management of the natural product chemistry laboratory. Since these changes, many assumptions and perceptions have emerged among students.

Students' perceptions can be influenced by the commitment and competence of lecturers (Baram-Tsabari & Segev, 2011; Iman et al., 2021; Ngan et al., 2020; Sulaeman et al., 2020). The components in the laboratory activity,

which include planning, infrastructure, and evaluation systems, contribute to increasing the success of the laboratory activity (Baram-Tsabari et al., 2006). Based on the conditions that have been described, this article discusses students' perceptions of the implementation of the natural product chemistry laboratory at a state university in Nusa Tenggara Barat, Indonesia.

METHOD

This research approach was descriptive qualitative obtained from observation, documentation, interview, and questionnaire. Respondents consisted of 59 third-year students from the Department of Chemistry Education at one of the State universities in West Nusa Tenggara, Indonesia, during the second semester of the 2020/2021 academic year.

Natural products chemistry laboratory using *Sasambo* medicinal plants begins with a laboratory project, namely "How is the process of isolating secondary metabolites from the *Sasambo* medicinal plant?". The novelty of this research is the use of *sasambo* medicinal plants in laboratory activities. The team determined the *Sasambo* medicinal plant species used in this laboratory based on the results of the previous isolation. The selection of the *Sasambo* medicinal plant took into account the difficulty

level of isolation of its secondary metabolite compounds. The high level of difficulty causes students to fail in their laboratory projects. Likewise, the level of difficulty that is too low causes students to feel that there is no challenge.

Implementation the natural product chemistry laboratory using *Sasambo* medicinal plants was carried out on 59 students according to the covid 19 protocol. After the online division of groups and plant species, students were asked to conduct a literature study on the *Sasambo* plant species, which became their laboratory project (Ani et al., 2018; Ariadi, 2017; Jannah & Ridwan, 2017, Jannah & Safnowandi, 2018; Yamin et al., 2018). From the literature study, students design their isolation procedures.

Lecturers and laboratory assistants guide and inform the students on what they should do in their laboratory project proposals. Students present the simple laboratory proposals online. Lecturers, laboratory assistants, and students from other groups respond to the proposals presented. After the proposal was corrected based on the suggestions of lecturers and laboratory assistants, the students can implement the laboratory design. The students implemented the laboratory activity in groups in turns according to the covid

19 protocol. At this implementation stage, the students can better understand the secondary metabolite isolation process concepts. After the implementation phase, the students make a report and present the results via online.

Table 1. The questionnaire of implementation of natural product chemistry laboratory

No	Statement
Planning	
1	There is good communication between lecturers and laboratory assistants
2	There is a common perception between laboratory assistants
3	Students are divided into small groups
4	Students participate in preparing practical equipment and materials
5	Students already understand the purpose and material to be practiced
Infrastructure	
6	Tools and materials are available to carry out the isolation of secondary metabolites from the medicinal plant <i>Sasambo</i>
7	The laboratory has good ventilation and lighting
8	Tools and materials in damaged condition
9	The laboratory is dirty
Learning resources	
10	Interesting practicum module to learn
11	The practicum module supports the implementation of the isolation of secondary metabolites from the medicinal plant <i>Sasambo</i>
12	The module deviates from the practical purpose
13	The material in the practicum module is difficult to understand
Laboratory implementation	
14	Practical strategies can optimize collaboration
15	Laboratory is coordinated in good category
16	Assistance activities help to understand practical material
17	Educational practicum strategies to work effectively
18	Efficient practice time
19	Practical time is not enough to complete the isolation of secondary metabolites from the medicinal plant <i>Sasambo</i>
20	Implementation of practical activities not according to schedule
21	The isolation of secondary metabolites from the medicinal plant <i>Sasambo</i> is difficult
22	The assistance activities carried out are not clear
23	The practicum strategy applied is less educational for discipline
Evaluation system	
24	The pretest questions are in accordance with the module and how the practicum works
25	Post-test questions are able to measure practical understanding
26	The pretest question is not related to the material presented
27	Post-test questions deviate from practical activities

The questionnaire given to the respondents consisted of 27 statements comprised of the variable planning, infrastructure, learning resources, laboratory implementation, and evaluation system. The questionnaire was trial to 10 respondents to ensure its validity. The validity of item statements is analyzed using product-moment correlation. The results of the analysis showed that all the statements were valid.

The quality of the implementation of the natural product chemistry laboratory based on students' perceptions was analyzed descriptively by percentage with the following formula (Sudjana, 2001):

$$P = \frac{f}{N} \times 100\% \quad (1)$$

Description:

P = Percentage

F = Frequency

N = Amount

In determining the validity of the data using a triangulation examination technique. Triangulation techniques include questionnaires, interviews, and documentation.

RESULT AND DISCUSSION

Planning a natural product chemistry laboratory involves communication between lecturers and laboratory assistants, common perception between laboratory assistants, group arrangement, Jurnal Penelitian dan Pembelajaran IPA Vol. 8, No. 1, 2022, p. 13-26

organization of laboratory tools and materials, and the accuracy of delivering information to students. Based on the results described in Figure 1 shows that the planning of the natural product chemistry laboratory has been going very well. There were some statements: communication lecturer with assistant laboratory, the same perception among assistants, group arrangement, organization tools and materials, and the accuracy of delivering information to students.

More than 25% of the respondents had doubts about the communication aspect. It is due to the lack of ability of the laboratory assistant to convey the message that the lecturer has given. The solution is to improve lecturer communication with laboratory assistants in easy-to-understand language.

More than 25% of the respondents doubted the determination of the student group. Some group members are not close friends. They do not feel comfortable working together. The solution can be done to exchanging group members who have not been able to establish teamwork.

More than 25% of respondents felt to understand the objectives and materials of the Natural product chemistry laboratory using *Sasambo* medicinal plants. The

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respondents have just received experience in a project-based laboratory. Previously, respondents had a lot of expository laboratories. The impact on laboratory activities is that some students do not understand the objectives of laboratory activities.



Figure 1. Percentage of Answers to Laboratory Planning

The implementation of the laboratory activity could run smoothly if adequate facilities and infrastructure support it in accordance with the need for the isolation of secondary metabolite compounds from medicinal plants (Fung & Watts, 2019). There were some statements: "I got the tools and materials I needed to carry out the natural product chemistry laboratory, the laboratory room has ventilation for air circulation and adequate lighting, tools, and materials were in a damaged condition and cannot be used, dirty and messy laboratory room". The results of the calculation of student perception questionnaires about facilities and infrastructure are shown in Figure 2.

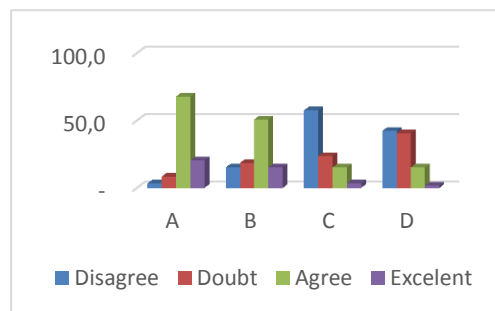


Figure 2. Percentage of Answers for Facilities and Infrastructure Description

Most respondents agree that the tools and materials used were in good and proper condition and the room used was clean. The questionnaire data in Figure 2 was supported by students' statements who stated that most of the things needed had been fulfilled.

A small number of respondents do not get the tools and materials needed during the practicum. There are only two evaporators in the laboratory, so they are used interchangeably. This is not a problem because it is only about 10 minutes of using the evaporator for each group in a series of isolation activities. A small number of respondents find tools and materials in a state that cannot be used. Tools that have been damaged can be replaced by reporting to the laboratory assistant. In contrast, expired materials that are not available in the laboratory can be replaced using alternative materials with the same function.

Most of the respondents thought the laboratory was dirty and messy. The laboratory is not yet fully organized, but

this does not significantly affect laboratory activities. In the future, the laboratory will be more organized.

Learning resources used in the natural product chemistry laboratory were laboratory guidelines made by lecturers. Students were also asked to conduct a literature study via the internet. There were some statements: module of natural product chemistry was interested in studying for supporting the implementation of laboratory activity, the module of natural product chemistry deviated from the laboratory goals or planned targets, the module of natural product chemistry was difficult to understand, for learning resources, what is revealed in this research is regarding the quality of practicum guidelines with the following details.

The natural product chemistry laboratory guidelines used were interesting to study, and the laboratory guidelines used to support the implementation of the laboratory activity. In line with this, the respondents also stated that the laboratory guidelines were in accordance with the laboratory objectives or planned targets. Most of the respondents had no difficulty in learning the material from the laboratory guidelines.

Almost 20% of the respondents were not interested in the modules

presented. Respondents are not interested in the modules presented because the presentation of the modules is still monotonous and sentences are still not concise, and there are still typing errors. Improvements to the module will be made by using effective sentences, adding images, and colors and correcting typing errors. Almost 25% of the respondents were doubtful about the benefits of the module. The module presented is still not concise, so some respondents still have difficulty understanding it.

Almost 50% of the respondents agreed and were unsure about the objectives and practicum plans contained in the module. Respondents did not understand the objectives and practicum plans in the module because the sentences used were not concise and students did not have experience isolating secondary metabolites at all. Oral explanations must guide students to be able to understand well the objectives and plans written in the module.

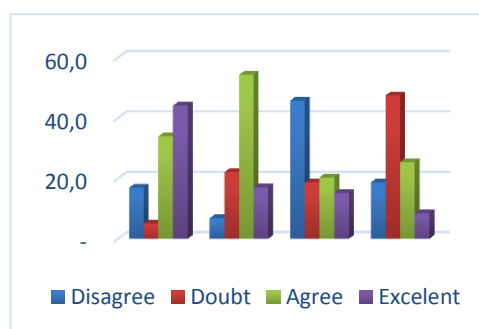


Figure 3. Percentage of Answers Learning Resources

Regarding the implementation of laboratory activities revealed in this research, the strategies used, the readiness of assistants and lecturers, the influence of assistance activities in understanding the material for students, efficiency and effectiveness of implementation time natural product chemistry laboratory (Bolte, 2008). The details of the data shown in Figure 4.

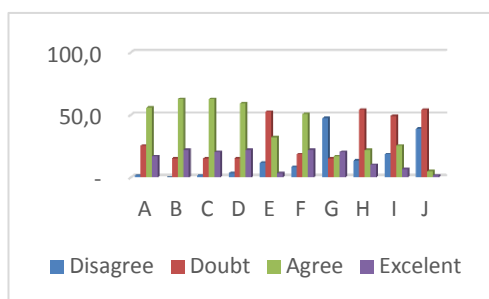


Figure 4. Percentage of Answers for Implementation of Laboratory Activities

There were some statements: the applied learning strategy can optimize cooperation, natural product chemistry laboratory was structured and coordinated very well, assistance activities make it easier to understand laboratory material, learning strategies that are applied to education to work effectively and efficiently, and the time to carry out the practicum (surgery and pictures) was quite effective and efficient, with the learning strategies applied, students lack time to draw and dissect, implementation of laboratory activities not according to schedule, laboratory guideline difficult to apply, the assistance media used was not clear,

The laboratory model applied was less educational for discipline and on time

Figure 4 shows that the natural product chemistry laboratory using *Sasambo* medicinal plants could optimize collaboration between students and lecturers to work effectively. The natural product chemistry laboratory activities were coordinated, and laboratory assistance made it easier for students to understand laboratory material. Most students feel that the time to carry out laboratory work was effective.

The data was supported by the results of the interview in which the students stated that the overall natural product chemistry was in good criteria. The advantage of this model was that the students were more focused, so they would always concentrate.

The evaluation system, the questions tested on students, the ability to measure individual abilities, and the suitability of the evaluation with the material that has been studied (Irby et al., 2018; Hasanah & Shimizu, 2020). There are statements: The pretest questions were in accordance with the module and how the laboratory works, posttest strategy was able to measure individual abilities, the pretest questions were not related to the material presented, post-test questions deviate from laboratory activities and materials.

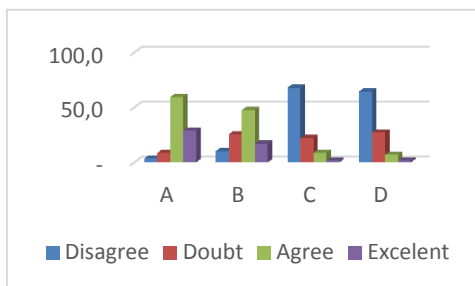


Figure 5. Percentage of Answers Evaluation System

Figure 5 shows that most respondents feel that the pretest questions given were in accordance with the guidelines and laboratory models and were related to the material presented. Post-test questions were able to measure the ability of each student. They can measure the ability to work together in groups and not deviate from the activities and laboratory materials. In line with the questionnaire, the results of the interviews showed that the pretest and posttest questions were in accordance with the guidelines and laboratory models implemented.

Lecturer's performance was important in laboratory activities that included planning the laboratory's implementation (Latimer et al., 2018; Luckie et al., 2020; Mancheño et al., 2019). Commitment and competence of lecturers and student satisfaction have a strong positive relationship (Monga et al., 2019; Moozeh et al., 2019). The competence of a lecturer was divided into three areas—first, competence in cognitive fields such as mastery of

material and intellectual abilities. Second, competence in attitudes such as respecting and loving work, tolerance, and having the hard ability to improve their work results. Third, behavioral competencies include teaching, guiding, assessing, associating, and communicating with students (Sabri, 2005). The lecturer has carried out his function well in the natural product chemistry laboratory using *Sasambo* medicinal plants. Lecturers have prepared laboratory concepts as well as tools and materials needed. The availability of facilities and infrastructure greatly affects the smooth running of laboratory activities.

A good laboratory must be equipped with various facilities to facilitate laboratory users carrying out their activities (Novalia et al., 2015; Qadar et al., 2018). The facilities and infrastructure used in the natural product chemistry laboratory using *Sasambo* medicinal plants were suitable. The laboratory room was in proper condition and had ventilation for air circulation and adequate lighting. The natural product chemistry laboratory used volatile solvents, requiring air rotation equipment. The existence of this suction fan can help air change for the better. The results of this study are in line with several relevant studies that have been carried out

previously (Darmaji et al., 2020; Berlianti et al., 2020)

The learning resources in the natural product chemistry laboratory using *Sasambo* medicinal plants were laboratory guidelines prepared by lecturers. Based on the research results on student perceptions, most of the students stated that the laboratory guidelines were interesting to study and in accordance with the laboratory carried out. However, some students also stated that the laboratory guidelines were difficult to learn because there were too many materials. In addition, there are still many sentences that have typing errors, so they require improvement during assistance. Students' expectations for the laboratory guidelines were updated again, especially on typos.

Laboratory assistance was carried out online. During the assistantship activity, the students saw the secondary metabolite isolation video and listened to the assistant's explanation. Video can be used as a way of delivering lessons. Videos can convey concretely educational messages in detail (Hasanah & Nulhakim, 2015; Saripudin et al., 2018).

During the laboratory activity, each group conducted a literature study on the procedure for isolating secondary metabolites. Then each group presented

the procedures that had been obtained in class. Procedures that the lecturer has approved can be directly implemented in the laboratory.

Overall, this research indicated that most of the students' perceptions stated that the natural product chemistry laboratory using *Sasambo* medicinal plants was in a good category. The laboratory model can optimize cooperation, make it easier to understand laboratory material, educate to work effectively and efficiently, make it easier to learn how to isolate secondary metabolites through direct experience, and educate discipline and be on time. However, there are still students who say otherwise. This is because the practitioner feels a lack of time to complete laboratory activities.

CONCLUSION

The natural product chemistry laboratory planning using *Sasambo* medicinal plants was in good criteria and has been arranged coherently. The facilities and infrastructure in the natural product chemistry laboratory using *Sasambo* medicinal plants were complete and suitable. The laboratory guide was interesting, but there were still many mistakes in typing, even though most students have no difficulty learning it. The laboratory model could optimize cooperation, make it easier to

understand laboratory material, educate to work effectively and efficiently, make it easier to study the isolation of secondary metabolites, educate discipline and be on time.

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