

Application of Inquiry-Based Learning Module to Improve Science Process Skills and Student Learning Outcomes

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Abstract: The purpose of this study was to determine the application of inquiry-based learning modules to science process skills and student learning outcomes in aquatic ecology courses at the Faculty of Fisheries and Marine Sciences, Teuku Umar University. This research method is pre-experimental with one group pretest-posttest design. The population in this study were all students at the Faculty of Fisheries and Marine Sciences, Teuku Umar University. The sample in this study was students in the odd semester of the 2019/2020 Academic Year in the Fisheries and Marine Studies Program, totaling 105 students and 5 classes taking Aquatic Ecology courses, namely the Fisheries, Aquaculture and Aquatic Resources study program. The results showed that the application of inquiry-based learning modules could improve science process skills in aquatic ecology courses at the Faculty of Fisheries and Marine Sciences, Teuku Umar University. The results of the analysis prove that the average percentage of students' Science Process Skills on indicators of observation is 85.08, interpretation is 60.32, classification is 92.06, communication is 77.78, experiment is 70.16, and principle is 66.98. The application of inquiry-based learning modules can improve student learning outcomes in aquatic ecology courses at the Faculty of Fisheries and Marine Sciences, Teuku Umar University. The results of the average increase in student learning outcomes pretest 42.93, posttest 76.5, and N-gain 62.82. While the results of the average difference test indicate that the significance value is 0.013 < 0.05, meaning that there is a difference in the average student learning outcomes before and after applying the guided inquiry module. Based on the results of research that has been done, it can be concluded that there is an increase in science process skills and student learning outcomes.

Keywords: Inquiry-Based Module; Science Process Skills; Learning Outcomes

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Introduction

Science process skills are skills possessed by students in the scientific process, including in the investigation process, or when conducting scientific inquiries. The need to instill science process skills in students so that students are able to solve a problem through scientific investigations, so that they can relate to phenomena in everyday life. Hunaepi et al (2020) define Science Process Skills as skills that help in

learning, provide variety in methods and ways to conduct experiments, increase student activity and responsibility, help students understand practically, and increase their sense of responsibility for independent learning. Science Process Skills are skills related to student understandings of science. The importance of instilling Science Process Skills in students considering current courses that require these student skills in order to be able to relate the phenomena around them to the material being studied.

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In this case, a student's skills are needed to be more independent in learning.

Science Process Skills are very important for students in terms of lecture aspects, because the general products that are demanded by many courses are resumes and papers, so written and concluded communication skills are needed (Syazali et al, 2021). Science process skills equip students with problem-solving skills by applying a scientific mindset and attitude in inquiry activities (Verawati, 2013).

In improving science process skills, a supportive learning model is needed. One of them is through the application of teaching materials based on the inquiry learning model. The use of learning modules is an option that is very supportive in the learning process. Through the use of the module, students are required to learn independently, by improving the skills of each student in justifying a problem in the learning process.

Based on the results of observations made in several study programs at FPIK, Teuku Umar University, especially the Aquatic Ecology course, it shows that science process skills in the learning process are still low, especially in terms of skills in using practical tools. The results of interviews with students who took the Aquatic Ecology course in January 2019 at UTU revealed that the learning module that had been used so far in the lecture process was the ordinary learning module, in which the module did not state the model steps or steps that had to be taken. Modules are usually used during the practicum.

Learning modules are very necessary in the learning process, both in the lecture process or in practical activities. Apart from being a practical guide, the module can also be designed to direct students to be able to work with scientific steps. Module teaching materials must be arranged systematically and attractively so that students can learn independently, as stated by Anwar (2010) learning modules are teaching materials that are arranged systematically and attractively which includes material content, methods and evaluations that can be used independently to achieve expected competencies.

The difference between the use of the learning module in this study and previous research is the use of the inquiry model that contains it, as well as the material and location of the research. Based on the results of a review of the application of the inquiry model, this model is able to involve, direct, and require students to find concepts independently. The integration between the module and the inquiry model is very good for use in the learning process. Goddess (2017); Concerned et al (2017); Astuti & Olenia (2019); & Qadariah et al (2019) said that the presentation of an inquiry-based module that seeks to instill the basics of scientific thinking in students so that in the learning

process students learn more on their own, develop creativity in solving problems.

The application of this inquiry-based module has advantages in improving Science Process Skills and student learning outcomes. This is in accordance with what Sodikun et al. (2016) stated that the module packed with practicum techniques and discussions in an inquiry-based form made students more motivated and sharpened their science process skills. Arantika et al (2018) & Adromeda et al (2019) say that the application of guided inquiry-based modules has an effective influence on developing science process skills and student learning outcomes. This proves that the use of this inquiry-based module is able to improve students' Science Process Skills and student learning outcomes are better than the use of ordinary modules.

Method

The approach in this study is a quantitative approach. The method used is a pre-experimental method with a one group pretest-posttest design. The design in this study can be seen in Table 1.

Table 1. One Group Pretest-Posttest Design

Pretest	Treatment	Posttest
O ₁	X	O ₂

(Sugiyono, 2018)

Information:

O₁ : Test before learning using the module

X₁ : Treatment, namely learning while using inquiry based module

O₂ : Test after learning using the module

The population in this study were all students at the Faculty of Fisheries and Marine Sciences, Teuku Umar University, consisting of 160 students. The sampling technique in this study is a non-probability technique with purposive sampling technique. The sample in this study were students in the Odd semester of the 2019/2020 Academic Year at the Fisheries and Marine Studies Program, Faculty of Fisheries and Marine Sciences, Teuku Umar University totaling 105 students and 5 classes taking Aquatic Ecology courses, namely Fisheries, Aquaculture and Aquatic Resources Study Programs.

The instrument used in this study was an observation sheet to measure PPP. Meanwhile, to measure student learning outcomes using test questions. The technique of analyzing PPP data is using an observation sheet and then the percentage of the results. The scores obtained by each indicator are added up and the result is called the total score. Furthermore, the percentage of average value is

calculated by dividing the total score by the maximum multiplied by 100%. The rating scale is made with a range from 1 to 3. Interpreters of these numbers are 1 = poor, 2 = moderate, 3 = very good. Calculation of students' science process skills data is done by analyzing observation sheets with equations (Arikunto, 2006).

$$P = \frac{S}{N} \times 100\% \tag{1}$$

Information:

- P : Presentage
- S : Total score obtained
- N : Total Score

The criteria for the observation value of science process skills are presented in Table 2.

Table 2. Table of Categories of Science Process Skills

No	Values Score (%)	Categories
1	(81 -100)	Highest
2	(61-80)	High
3	(41-60)	Medium
4	(21-40)	Low
5	(0-20)	Lowest

(Suwandi, 2011)

The technique of analyzing student learning outcomes data can use the N-gain Meltzer equation (2002).

$$g = \frac{\text{Posttest score} - \text{pretest score}}{\text{maximum possible score} - \text{Pretest score}} \tag{2}$$

Table 3. Criteria for N-gain

No	range	Criteria
1	(<g>) > 0.7	High
2	0.7 > (<g>) > 0.3	Medium
3	(<g> < 0.3	Low

(Hake, 1999)

Next, perform statistical testing by conducting prerequisite tests, namely the normality test and the Wilcoxon test and the last test is the one sample t test.

Result and Discussion

Science Process Skills

Data on students' science process skills through observation sheets after giving an inquiry-based learning module to the experimental class on aquatic ecology material. The analysis of students' science process skills scores can be seen in the percentage of aspects of science process skills (Figure 1).

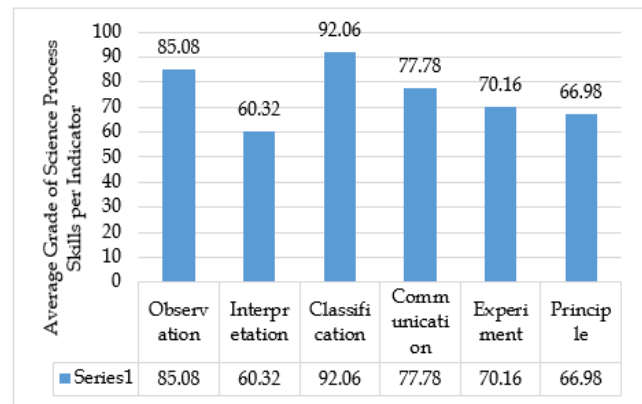


Figure 1. Percentage of Aspects of Science Process Skills

Figure 1 shows the results of the analysis of students' science process skills through the implementation of an inquiry-based module. Based on the results of data analysis on the six indicators, the average value of observation is 85.08% and classification is 92.06% categorized as very high, communication is 77.78%, experimental is 70.16%, and 66.98% is categorized as high, interpretation is 60.32% categorized as moderate. This is in accordance with previous research conducted by Novitasari et al (2016) that the module is one of the teaching materials that can actively involve students and not only emphasizes cognitive aspects but also psychomotor and attitude aspects.

Through inquiry learning, students can increase self-confidence, students can formulate their own findings well, after they maximize their abilities in a systematic, critical, logical, and analytical way to search for and investigate things such as objects, people or events in inquiry-based learning. Damopolii et al, 2018). The use of this inquiry-based module is also proven to be able to guide students to carry out scientific processes in their practical activities, so that students' Science Process Skills can increase after using the inquiry module (Furqan et al, 2016).

Student Learning Outcomes

Data collection on student learning outcomes in aquatic ecology courses with inquiry-based learning modules in the experimental class is carried out by looking at the initial abilities carried out before the learning process. Furthermore, to determine the final ability of students after the learning process is carried out by giving a final ability test. The learning outcomes of the experimental class are presented in Figure 2.

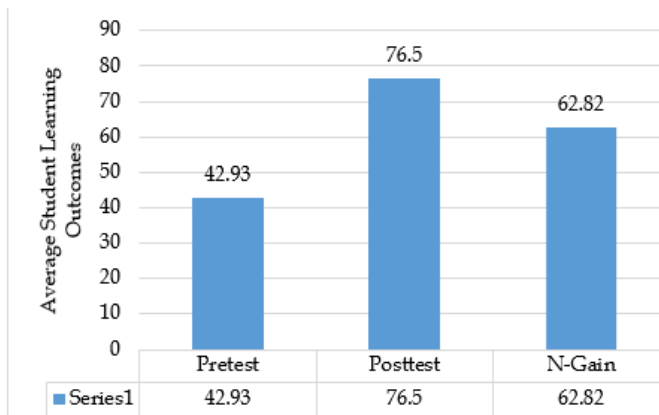


Figure 2. Average Pretest, Posttest and N Gain scores

Based on Figure 2 shows that student learning outcomes on prior knowledge are very low with an average score of 42.93% pretest results. The results of the final knowledge with an average posttest score of 76.50% are included in the good category. The increase in learning outcomes (n-gain) is included in the sufficient category. The results obtained prove that the implementation of the inquiry-based module can improve student learning outcomes better than before. This is in accordance with the research conducted by the test results of the average pretest score with the posttest score of student learning outcomes in Table 3 below.

Table 3. The results of the average difference test and the normality of the pretest with the posttest of student learning outcomes

Score	Average (%)	Normality*)	Significance**)
Pretest	42.93	Normal Sig: 0.200	Significance Sig: 0.00 > 0.05
Posttest	76.50	Tidak Normal Sig: 0.047	Signifikan Sig: 0.00 < 0.05

Information:

*) = Kolmogrov-Smirnov Test (Normal, Sig.> α 0,05)

***) = Wilcoxon (Signifikan, Sig.< α 0,05)

Table 3 shows that the pretest data or students' initial ability is very low, namely 42.93%. While the posttest data or the final ability of students showed very good 76.50%. Both pretest and posttest groups had normal and non-homogeneous distributions. So, the data obtained are not normally distributed based on the Kolmogorov-Smirnov test. So that the hypothesis test is continued with the Wilcoxon nonparametric test. While the average score of n-gain learning outcomes can be seen in Table 4 below.

Table 4. The results of the N-Gain Mean Difference Test and the Normality of Student Learning Outcomes

Learning Outcomes	Average	Normality*)	Significance**)
N-Gain	62.82	Normal Sig: 0.000	Significance Sig: 0.013 < 0.05

Information:

*) = Kolmogrov-Smirnov Test (Normal, Sig.> α 0,05)

***) = Non Parametrik (Signifikan, Sig. < α 0,05)

Table 4 shows significant differences. Therefore, it can be believed that the application of inquiry-based learning modules is very effective in improving student learning outcomes.

Conclusion

Based on the results of research on the application of inquiry-based learning modules, it can be concluded that the application of inquiry-based learning modules can improve science process skills in aquatic ecology courses at the faculty of fisheries and marine sciences, Teuku Umar University. The results of the analysis prove that the average percentage of students' science process skills on indicators of observation is 85.08, interpretation is 60.32, classification is 92.06, communication is 77.78, experiment is 70.16, and principle is 66.98. The application of inquiry-based learning modules can improve student learning outcomes in aquatic ecology courses at the faculty of fisheries and marine sciences, Teuku Umar University. The results of the average increase in student learning outcomes pretest 42.93, posttest 76.5, and N-gain 62.82. While the results of the average difference test indicate that the significance value is 0.013 < 0.05, meaning that there is a difference in the average student learning outcomes before and after applying the guided inquiry module.

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