

Evaluation of the Effectiveness of Practical Inquiry-based Biology Course

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Abstract—This research aims to assess the implementation of collaborative inquiry-based in practical of General Biology and its impact on students' understanding. The method used in this study is a descriptive method with a quantitative approach. The population of this study was 110 undergraduate students at the first-year of Biology Education of UIN STS Jambi, while the number of samples was 50 students taken by simple random sampling technique. The implementation of the strategy was evaluated using observation and questionnaire. Furthermore, the impact of the collaborative inquiry-based on students' understanding was measured quantitatively using an instrument test. Overall, the implementation of the practical class using collaborative inquiry-based has met a very good category, indicating all the syntax of the inquiry approach has implemented during the teaching process. Unexpectedly, students' understanding test found only a few of students met the satisfactory grade results, suggesting further improvements for the media used in the collaborative inquiry-based approach.

Keywords—*inquiry-based; collaborative; general biology*

I. INTRODUCTION

In the college and University, science classes are generally separated into two components, i.e., lecture/recitations and laboratory sections [1]. Basically, a practicum is laboratory work that is given to provide a real activity for improving students understanding about fundamental subjects [2]. Practicum is a method to improve professional knowledge, skills, the ability of observation, experience, reflection, understanding, and attitude [3]. The implementation of this method in the teaching process has successfully increased student achievement [4].

The activities of the practicum are a scientific activity exercise consisting of experiments, observations, and demonstrations which show the connection between theory and phenomena carried out in the laboratory and outside the laboratory [5]. Practicum allows students to apply skill or practices [6]. Practicum introduces student with a) the idea, observing phenomena, creating a hypothesis; b) the test, deciding on variables and control; c) analysis, what the results mean; d) the theoretical context for what else is known; e) deciding what the next question or experiment might be; and f) writing the scientific paper including submission, review, revision [7].

General biology is one of the compulsory courses for biology education students of UIN STS Jambi. This subject is prerequisite for advanced level subjects. This course consists of theoretical and practical work for experiencing students in laboratory work skills and facilitating the connection between concepts and context. This is in line with science learning, that science is not simply a body of knowledge to be transmitted to the students, science educators have advocated that learning science should also include ways of scientific thinking, methods, and processes [8].

Practicum is very important for students in science education [9], especially biology education because practicum process can give students a feeling for the phenomena that can help them to understand the knowledge about the natural world [9,10]. Practicum used in science teaching to support theoretical science instruction [8] and facilitate students to construct their knowledge through laboratory activities [9,11].

The research about practicum process has often been conducted, as assessing experiment process in guided inquiry [12], tensions in the biology laboratory [8], better practicum training [13], improves practicum for a better teacher training [14]. However, there is less research about assessing practicum process based on collaborative inquiry-based learning.

Practicum based on collaborative inquiry is a learning process in science education with support by the computer to improve student knowledge [15,16]. Collaborative inquiry is a process of learning which have a direct effect on student knowledge, understanding, and ability [16]. The result of collaborative inquiry practicum is the students get knowledge about how doing science, study about the characteristic of science and scientific content [15].

There are many benefits to implementing inquiry learning. Inquiry learning can stimulate students to formulate and deliver questions, developing hypotheses, designing experiments to test the hypotheses, collecting the data, discussing results, evaluating processes, and making conclusions [17]. Inquiry learning is learning that involves students as active participants in solving problems [18,19]. The use of inquiry in learning improves both the quality of teaching processes and students' understanding [20]. Here, this research aims to assess the practicum process based on collaborative inquiry-based

learning on General Biology and the impact of the implementation of this approach on students' achievement.

II. METHOD

This research was conducted using a descriptive method with a quantitative approach. The population of this research was 110 undergraduate students at the first-year of Biology Education of UIN STS Jambi on academic year 2017/2018. The number of samples in this research was 50 students which taken by simple random sampling technique.

In this research, students learned practical general biology using collaborative inquiry-based that combined real experiments and videos as a virtual laboratory. The collaborative inquiry-based practical is developed by referring to the previous study [15] which consist of 1) orienting and asking questions, 2) hypothesis generation, 3) planning, 4) investigations, 5) analysis and interpretation, 6) exploration and creation model, 7) conclusion and evaluation, 8) communication, and 9) prediction. The video was integrated to explore, test, and strengthen the results of real investigations. The video was given at the exploration and creation phase.

The assessment for the learning approach implementation was collected through questionnaire and observation sheet, while the impact of collaborative inquiry-based implementation was evaluated using an instrument test. The data were analyzed as a percentage of students answer using statistic descriptive [21]. The criteria of implementation refer to category expressed by Ridwan [22].

III. RESULT AND DISCUSSION

A. The Implementation of the Collaborative Inquiry Approach in General Biology Practicum

The observation of the implementation of the collaborative inquiry process found that almost all the steps of the collaborative inquiry have been implemented very well in the teaching and learning process (Table 1). Eventhough, as can be seen in the Table 1, more attention still have to be given to some aspects such as facilitating students to develop more scientific inquiry skills, such as formulating hypothesis, conducting investigation for answering hypotesis, doing exploration and creating models, and making prediction based on the pattern of the data. Those skills are important because the essential goal of science learning is to form scientific explanation through inquiry process not only to obtain the existing scientific explanation. Integrating videos as virtual laboratory instead of wet lab experiments aim to assist students to face to the different learning experience that can help them to easily get the knowledge. Looking at the result of the questionnaire (Figure 1), it is also shown that time is still considering as the component that should be improved in conducting real experiments in the teaching process. Yet, it provides motivation for students which are expecting can enhance students' understanding about the concepts they learned.

TABLE I. PROFILE OF EACH STAGES OF COLLABORATIVE INQUIRY IN GENERAL BIOLOGY PRACTICUM

| No | Aspect | Percentage (%) | Category |
|----|--------------------------------|----------------|-----------|
| 1 | Orienting and Asking Question | 96 | Very Good |
| 2 | Hypotesis Generation | 92 | Very Good |
| 3 | Planning | 98.4 | Very Good |
| 4 | Investigation | 93.8 | Very Good |
| 5 | Analysis and Interpretation | 100 | Very Good |
| 6 | Model Exploration and Creation | 92 | Very Good |
| 7 | Conclusion and Evaluation | 100 | Very Good |
| 8 | Communication | 100 | Very Good |
| 9 | Prediction | 92 | Very Good |

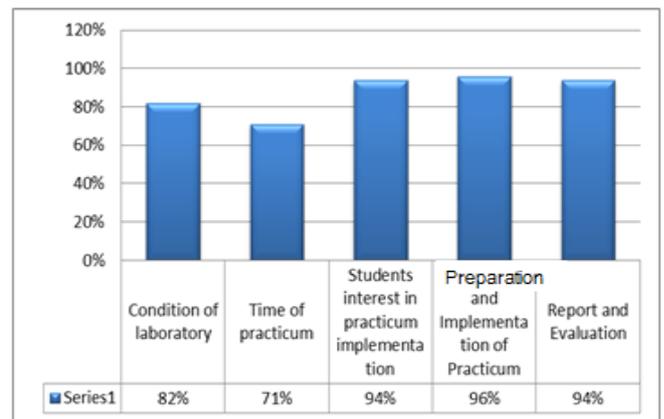


Fig. 1. Result of questionnaire.

B. Profile of Students' Understanding who Learned General Biology Practicum using Collaborative Inquiry

Implication of the implementation of the collaborative inquiry approach in practical of General Biology om students' understanding was measured using an instrument test. The result shows that more than thirty percent students have reached their good understanding through the implementation of the collaborative inquiry. It is evidenced by 36% students from total got A and B grade. It means their understanding got 4 to 3 from scale of 4, while almost half of the students (46%) reached to the average level of their understanding. Only a few of students still found to have weak understanding. This finding indicate the positive influence of student's motivation and engagement due to the implementation of collaborative inquiry on students' achievements.

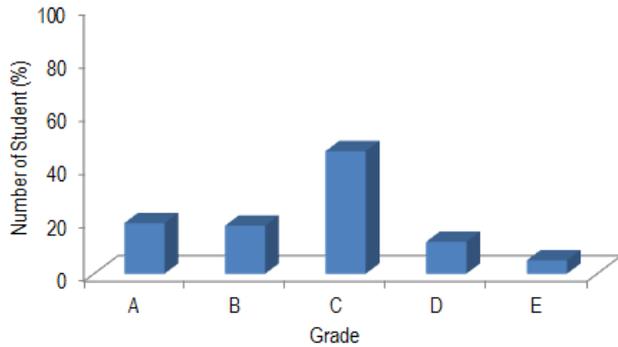


Fig. 2. Profile of students' achievement after learned practical general biology using collaborative inquiry.

This finding show that collaborative inquiry approach assisted by virtual laboratory had a positive implication on cognitive outcome. Here, collaborative inquiry approach also guided students in finding and using various sources of information to improve their understanding. Using this approach student were facilitated to develop their basic scientific ability that include orienting and asking questions, generating hypothesis, planning, doing investigations, conducting analysis and interpretation, exploring and creation model, making conclusion and doing evaluation, communication, and prediction. However, selecting the proper media (here videos) also found important since its content can serve concepts that students need when constructing their knowledge.

IV. CONCLUSION

Based on the results and discussion above, it could be concluded that almost all aspects of collaborative inquiry have been well implemented in the Practical of General Biology. The implementation of collaborative inquiry in the teaching process give positive implication on students' understanding. Furthermore, it is necessary to do research on some of the right media to be applied in collaborative inquiry.

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