Implementation of Guided Inquiry Learning With Scaffolding Strategy to Increase Critical Thinking Skills Of Biology Students’ Based On Lesson Study

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Abstract. The aims of this study were to describe the application of guided inquiry with a scaffolding strategy based on lesson study to improve critical thinking skills. This type of research is classroom action research. The results showed that guided inquiry with a scaffolding strategy based on lesson study can improve critical thinking skills. Guided inquiry is an inquiry learning model that actively involves students in the learning process directly and improves mastery of concepts. Scaffolding is learning in which students are given a number of assistance during the early stages of learning and then reduce assistance slowly and give responsibility to students to carry out the specified learning. Lesson Study can reflect the teaching and learning process in the classroom and has the potential to build a learning community in schools that results in improvements in the learning process and increases teacher knowledge that focuses on students and the material taught. The results showed that guided inquiry with a scaffolding strategy based on lesson study can improve critical thinking skills in applying indicators from cycle I to cycle II around 27.5%, analysing from cycle I to cycle II around 15%, using data from cycle I to cycle II around 15% and synthesized from cycle I to cycle II around 25%. It is hoped that further research will apply other models to improve critical thinking skills.

1. Introduction
The 21st century or called the century of knowledge is an open century that contains a variety of challenges and opportunities that demand superior quality of human resources, and can compete in life. Qualified human beings are human beings who can compete in a good sense [1] by forming a critical mindset, good reasoning, creative, and innovative. The life of the 21st century is very competitive and demands qualified human resources and competency in various areas of life thus learning should always be attempted to the development of life skills of the 21st century. Learning in the 21st century should now be adjusted with the progress of knowledge independently.

Learning biology in 21st century course for undergraduate students required independence and creativity to be able to adapt to the various demands and challenges that accompany it. Teachers or lecturers model determine the success aspects of classroom learning. Its role in teaching with strategies and models of learning that are fun and student learning that are fun and student learning experiences during learning. The guided inquiry learning model with a scaffolding strategy can guide students to teach their friends and make learning more meaningful and easy to understand and be understood by the students.
Blanchard et al. [2] found that the guided inquiry approach was more effective than the traditional learning approach in improving conceptualization. Guided inquiry is a type of inquiry learning that actively involves students in the learning process directly and improves mastery of student concepts rather than using passive strategies that are typically used in educational environments [3].

To guide students in overcoming difficulties in inquiry learning can be collaborated with scaffolding. Students who just understand something need scaffolding, because it will guide students have good academic development. Scaffolding is a lesson in which students are given some assistance during the early stages of learning and then reducing the aid and providing opportunities for students to take on greater responsibility after being able to do it on their own [4]. In this research three field work practice students (Master students) helps, guides, and directs the undergraduate students in teaching their peer.

Scaffolding is a learning technique in which students are given some help, then gradually reducing the aid and students are given an increasing responsibility for learning that has been established. Such assistance may be in the form of guidance, encouragement, warning, outlining problems for easier steps, providing examples and other actions that enable learners to learn on their own. Giving step-by-step support in learning and problem solving is important in modern constructivism. Students are given complex and realistic tasks, then given enough help to solve them. In line with this, [5] states that good teaching covers how students learn, how to remember, how to think and how to motivate themselves. Learning using guided inquiry model with scaffolding strategy guide students to cultivate creativity, collaborative, critical thinking, finding problems and solving problems and generating a fun atmosphere in learning.

Critical thinking skills is one of the high-level thinking skills that become indicators of achievement of educational goals and become one of the skills required of students. Empowering critical thinking skills that are done consistently in the learning process will make students skilled in managing their learning process independently and improve their thinking ability [6-8]. In addition, students will also be able to respond appropriately to the problems they encounter because students have the skills to analyze the problem, plan and execute settlement measures and be able to evaluate the settlement measures [9-11]. Ultimately, empowering critical thinking skills will determine the quality of learning [12].

The Use of guided inquiry model with scaffolding strategy can be learned through lesson study to improve the quality of learning so as to achieve the learning objectives. Lesson study can improve the learning objectives because through lesson study the teacher can reflect on the teaching and learning process in the classroom. Lesson study has the potential to build the learning community in the school so as to produce improved learning process and improve teacher knowledge which focuses on the students and the material being taught [13]. In an effort to apply effective collaborative learning and positively impact critical thinking skills and student learning outcomes through lesson study. Lesson study itself is one program that can improve the effectiveness of collaborative learning. This is because in the lesson study, teachers work together in solving classroom learning problems.

2. Method

This type of research is Classroom Action Research (PTK) based on LS with qualitative descriptive approach. In this study the author as a student of Field Work Practice who collaborated with Lesson Study team consisting of 5 university students who teach their friends. This study was conducted in 2 cycles. There are 4 stages in each, namely planning, implementation, observation, and reflection. In the implementation phase of PTK conducted LS which includes the stage plan (planning), do (action), see (observation).

Implementation of Lesson Study is done in 4 times round. The stages of the implementation of the lesson study consist of 3 stages: (1) planning stage, planning done with lesson study team to determine the learning model to be used, the model lecturer and the observation instrument to be used and the material chosen to be taught. The taught matrix is Characteristic of Learning Characteristic of 21st Century and Its Implementation, Problem Solving Skill and Metacognition on 21st Century Learning, Developing and Measuring Community Living Skills at 21st Century Learning, and Utilizing
Technology in supporting 21st Century Learning. (2) (do), the implementation stage is the implementation of the stage plan that has been designed in teams and (3) the reflection stage (see), reflection is used to see whether the implementation of lesson study has been running as expected or need improvement from certain aspects in order to improve the lesson study activity.

The subjects of this study are VII undergraduate students amounting to 32 students, consisting of 27 female students and 5 male students who take the course Biology Learning in 21st century. The data obtained in the study is data implementation of Lesson Study. Instrument used is observation sheet of implementation of Lesson Study that is plan, do, and see. Second data is critical thinking skill from student. This data is obtained from the results of oral tests of student questions and responses, ideas that students appear when working on Student Worksheet (LKM) at the time of teaching and learning

3. Results and Discussion

3.1. Learning Implementation

The implementation of LS is observed by observation using observation sheet at each stage, namely: plan, do, and see which is filled by 4 student observer. Field Work Practice is assisted by undergraduate students. The implementation of LS learning can be seen in Table 1.

| Indicator                        | Achievement (%) |
|----------------------------------|-----------------|
|                                  | Cycle I | Cycle II |
| Learning Implementation           | 90      | 100      |

3.2. The Implementation of Lesson Study

Stages of lesson study were analyzed every meeting, in this study there are 4 times lesson study lesson with lesson study steps include: plan, do and see. Based on the data recapitulation of the implementation of lesson study for cycle I and cycle II through the stages of plan, do, and see can be seen in Table 2.

| Circle     | Round   | Plan       | Do         | See        |
|------------|---------|------------|------------|------------|
| Circle I   | Round 1 | 100 (Very Good) | 79 (Good) | 80 (Good)  |
| Circle I   | Round 2 | 100 (Very Good) | 80 (Good) | 90 (Very Good) |
| Circle I   | Round 3 | 100 (Very Good) | 98 (Very Good) | 100 (Very Good) |
| Circle II  | Round 4 | 100 (Very Good) | 100 (Very Good) | 100 (Very Good) |

Based on the above data, it is known that the implementation of lesson study at the stage of the plan can be categorized very well because the arrangement of learning planning activities has been adjusted with the monitoring guidelines of the phase plan.

Implementation of lesson study at the do stage when learning activities obtained level of implementation of the percentage of 4 rounds is very good. The first round until the last round has increased. The implementation of the lesson study can be done well if the condition of the environment (class) also supports, including the availability of field work practices team who conduct assessment of the learning process implemented through the plan activities, do, see together. This situation is certainly
not separated from the role of model lecturers in conducting lesson study effectively in order to develop skills in teaching, both when planning the learning and during the course of learning activities. Lesson study can build model lecturers' capabilities through collegial learning, in the sense that model lecturers can learn from each other about what they feel is still lacking, both about their knowledge and skills in teaching students [14].

Furthermore, the implementation of lesson study at the stage, when the learning obtained the level of implementation of the percentage of the four meetings is very good. The level of implementation is very good because at this stage the moderator gives an opportunity to the lecturers of the lecturer model to express an opinion about the implementation of the lesson that has just been done by the model lecturer. Then the observer is given an opportunity to speak out on the observations that have been made and with the concrete evidence, the implementation of the see that has been done together shows that the lecturers of model can receive input from observers and lecturers of model to improve teaching in the classroom. A writer assigned to write what happened during the reflection activities so that the implementation of the stage can be done well with a team of lesson study.

Lesson study (LS) is a form of job training conducted collaboratively, independently, continuously by reviewing a topic, plotting scenarios, carrying out teaching and learning activities that are observed with others and followed by reflection and revision. If this is done continuously then the teacher's pedagogical ability will increase [15].

There are three stages of lesson study which are plan, do, see. This LS can generate creative and innovative learning strategies. Implementation of lesson study based on appropriate syntax will result in good learning results and outcomes. Lesson study activities are implemented with the main objective of improving the quality of student learning process and outcomes, include the plan stage, do, and see, then each model lecturer will be actively involved in these activities. Model lecturer have the opportunity to identify learning problems, review learning experiences, select alternative learning models, observe the implementation of learning, reflect together, and take valuable lessons from each process undertaken for the benefit of improving process quality and learning outcomes [16].

The valuable lesson that can be taken after applying the guided inquiry learning with the scaffolding strategy based on lesson study is that technically, time management is very important in learning activities, all aspects of the indicators can be implemented as expected. In addition, lesson study activities can form a better, creative, and innovative teaching team, because in the lesson study team there are collaboration of ideas and thoughts of team members in planning, implementing and evaluating a learning that will improve critical thinking skills and learning outcomes.

3.3. Critical Thinking
The observational data showed that students' critical thinking skills from the first round to the fourth round increased. This can be seen in Figure 1 below.

![Critical Thinking](image)

**Figure 1. Increasing Critical Thinking from Cycles I and II**

Based on the diagram above, it can be seen that all critical thinking indicators by using guided inquiry learning model with lesson study based scaffolding strategy have improved from all aspect starting from
applying, analyzing, using data and synthesizing, have experienced improvement as expected. The
results of questionnaires filled by observers 1, 2, 3, and 4 also experienced an increase in critical
thinking. Several aspects of the above improvement diagram can be seen in Figure 2 below.

Figure 2. Critical Thinking from Round 1 to 4

In the first cycle until the second cycle has increased as shown in Table 3.

Table 3. Indicators of Critical Thinking and Increasing Each Cycle

| Critical Thinking Indicators | Cycle I | Cycle II | Improvement |
|-----------------------------|---------|----------|-------------|
| Apply                       | 70      | 97,5     | 27,5        |
| Analyze                     | 80      | 95       | 15          |
| Using Data                  | 75      | 90       | 15          |
| Synthesizing                | 65      | 90       | 25          |

Implementation of guided inquiry model with scaffolding strategy can help the field work practice
students to guide the undergraduate students in teaching their friends and to optimize the learning
process in accordance with the characteristics of student learning. The model requires good planning
so that the required learning skills can be achieved.

According to [17], learning with guided inquiry model can help students hone their critical thinking
skills because in guided inquiry there is guidance of teachers in encouraging students to think about the
problems presented by teachers. The teacher's guidance is to teach how students should act on certain
points. Based on the results of research conducted by [18] that there is a significant effect of students'
critical thinking skills when taught with guided inquiry model. Research of [19] says that the
presentation of problems in inquiry learning encourages students to think through answers from different
points of view. Presentation of problems also stimulate students to think deeper.

In lesson study lessons can significantly improve students' critical, creative, and collaborative
thinking skills, as [20] points out that teacher roles and leadership in the learning process are the
determinants of the effectiveness of teaching and learning in the classroom. Lesson study used to realize
the learning of the better and more effective so that the expected learning objectives can be achieved.
[21] said the Lesson Study approach has become a common form of school practice in solving teaching
and learning problems while improving teacher skills.

4. Conclusions and Suggestion

4.1. Conclusion
The results showed that:
1. Guided inquiry learning with scaffolding strategy based on lesson study can be applied to improve critical thinking skills. By using stages of the lesson study stages are plan, do, and see that could be implemented properly will improve the quality of the learning process and outcomes.
2. The level of percentage of guided inquiry implementation with scaffolding strategy based on lesson study that has been done shows improvement every cycle.

4.2. Suggestion
Based on the results of research obtained, suggestions that can be given to further research as follows.
1. Lecturers need to have good organizing of time and endeavored to carry out the stages of learning to the maximum in order to improve students' critical thinking skills.
2. Learning process using guided inquiry model with scaffolding strategy can help teachers to optimize the learning process in accordance with the characteristics of student learning. Both these methods require good planning so that the desired learning skills can be achieved.
3. Classroom action research through lesson study activities needs to be developed by teachers because it is very useful to improve the quality of learning and learning process, because teachers get a lot of valuable lessons from peer advice and input.

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