# The Analytical Thinking Skills of Biology Education Students Through the Implementation of Biology Planning Learning Books

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**Abstract.** This study aims to determine the analytical thinking skills of biology education students from the application of the developed biology learning book. This research used two classes of student research subjects which are determined by purposive random sampling technique. Data was collected using questionnaire and essay test. The data were analyzed by percentage technique and t test. The results showed that the ability to set learning objectives is included in the very good category (91.84%), the ability to develop learning indicators is also good category (86.38%), the ability to design learning models is included in good category (84.62%), the ability to design instructional media is included in the good category (82.36%), and the ability to design evaluation is included in the very good category (92.46%).The analytical thinking skills of biology education students who are taught using biology learning book is higher than those who do not have developed book.

**Keywords:** Analytical Thinking, Biology Education, Biology Planning Learning.

## 1 Introduction

The teacher's job is basically to organize learning starting from planning, implementing and assessing student learning processes and outcomes. In the learning planning section, teachers need to prepare teaching methods and student learning goals [1]. The success of a teacher in implementing a learning strategy really depends on the teacher's ability to analyze existing learning conditions, such as learning objectives, student characteristics, learning resource constraints, and characteristics of the field of study [2]. All of this really needs to be arranged well in learning planning.

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The success of implementing learning really depends on the extent to which the learning was planned [3]. Preparing a good learning plan will result in obtaining good quality learning as well [4]. By preparing learning plans in a professional, systematic and effective manner, teachers can improve the quality of learning [5]. Thus, learning planning is a very important part of the learning process, taking into account educational principles [6].

Likewise, planning biology learning requires seriousness and attention to various factors. It is very important for prospective teachers to understand the learning planning process, both planning the use of learning media and planning the implementation of learning. Lase [7] states that preparing learning plans is basically an effort to improve the professionalism of a teacher's work. As well Nasution [8] adding that the preparation of learning plans needs to critically consider the learning objectives to be achieved. Developing appropriate learning objectives will be able to direct students to be able to implement them well.

In this research, the implementation of biology learning planning influenced the critical thinking abilities of biology education students. This is very important for prospective biology teacher students in pursuing professional skills as biology teachers. Students need to prepare and test skills in the field of pedagogy. This is very necessary because pedagogical skills are an important part in developing prospective biology teachers to face the increasingly rapid developments in science and technology.

The development of textbooks is very necessary to obtain satisfactory learning results. There are many characteristics that can be carried out according to the needs in developing textbooks. In this research, the development of a case-based Biology Learning Planning textbook was developed. In Anas' opinion [9] case-based textbooks are a way to innovate textbooks that can be implemented with students to improve optimal learning outcomes. Even obey Syafril and Rahmi [10] that by implementing case-based textbooks it can produce students who are able to solve cases in accordance with the demands of the independent learning curriculum.

Therefore, it is very important for biology education students as prospective biology teachers to have analytical thinking skills. For this reason, it is necessary to prepare a case-based Biology Learning Planning textbook during the learning process. It is hoped that students will become independent in solving problems contained in textbooks, and can also be used as a reference in group discussions when studying the content of the learning material. This is in line with the demands of the 21st century that students need to have critical thinking skills, creative thinking skills, good communication skills, and the ability to collaborate.

## 2 Method

This research was conducted on biology education students at Medan State University from April to September 2023. The research was carried out using the ADDIE model development approach, starting from Analysis, Design, Development, Implementation and Evaluation. However, in this article what is stated is only the product implementation stage to see the effect on students' analytical abilities. For this reason, an experimental design was carried out using pretest-posttest control carried out randomly from 6 classes in the Biology Education Study program.

There were 61 students involved in this research in two classes. The details were that 31 students were taken randomly for the experimental group, while 30 students for the control group were also randomly taken from biology education students determined by random sampling technique. The random sampling technique was used because the samples had the same chance of being selected as samples, and both were homogeneous.

The research instrument used a 20-question critical thinking ability test which was previously tested for validity and reliability. The validity test results show a high level of validity, namely a range from 0.72 to 0.88 and has a very high reliability, namely 0.94. Data on students' analytical thinking abilities were analyzed using the t test at a significance level of 5% with the help of the SPSS 26.0 computer program. Next, to find out how big the difference is between the two classes, an N-Gain test is carried out.

## 3 Results and Discussion

The pretest was carried out to determine students' initial analytical thinking abilities before using the Biology learning planning textbook. After implementation, a posttest was carried out. The pretest and posttest results can be seen in Table 1 below.

**Table 1.** Pretest and Posttest Analytical Thinking Average Score

| No. | Class | Pretest | Posttest |
|---|---|---|---|
| 1. | Experiment | 47.25 | 88.75 |
| 2. | Control | 48.10 | 70.25 |

From Table 1 it can be seen that the average pretest and posttest scores are not much different from the pretest average score of the control class of 48.10 and the experimental class of 47.25.

Based on the t test to determine the difference between analytical thinking abilities between the experimental group and the control group, it can be seen in Table 2 below.

**Table 2.** t-Test

| Data | Class | A | Sig.t (p-value) | Conclusion |
|---|---|---|---|---|
| Pretest | Experiment<br>Control | 0.05 | 0.832 | Not a significant difference |
| Posttest | Experiment<br>Control | 0.05 | 0.000 | There are significant differences |

From Table 2 above, it can be seen that before implementing the Biology Learning Planning textbook for biology education students, there was no difference in the analytical thinking abilities of students in the two classes. However, at the post-test after implementation, it turned out that there were significant differences. This shows that the analytical thinking

abilities of experimental group students are significantly different from those of the control group.

Based on the N-Gain test in the experimental class and control class, the results obtained are as shown in Table 3 below.

**Table 3.** N-Gain Test Results

| No | Class | Average Value |
|---|---|---|
| 1. | Experiment | 63.67 |
| 2. | Control | 45.16 |

From Table 3 it can be seen that the average N-gain value in the experimental class, namely 63.67, is quite effective and is higher compared to the N-gain value in the control class, namely 45.16, which is classified as less effective. Thus, it can be said that the use of case-based Biology Learning Planning textbooks has a fairly good level of effectiveness on the analytical thinking abilities of biology education students. The percentage difference in increasing students' analytical abilities between the experimental group and the control group was 18.51%.

The results of this research show that the analytical thinking ability of biology education students by implementing case-based textbooks is higher in the experimental group than the control group. This means that students who are taught using case-based Biology Learning Planning textbooks are better and more effective in encouraging their analytical abilities. This is in line with the results of research conducted by Anas [9] case-based textbooks can produce better student achievement and this is also an innovation in learning.

Students' analytical abilities are really needed to continue to be improved. This is in line with the opinion of Triyono [11] who states that analytical skills can be used by students in the thinking process to make it easier for students to improve their learning achievements. Likewise, the opinion of Ahmad and Megawati [12] states that analytical skills can improve students' problem-solving abilities.

Planning biology lessons is important for student teachers, including biology teachers. By providing students with case-based textbooks, students will be able to learn using their analytical skills. According to Prasetiyaningsih, analytical thinking skills are a barometer for students in using thought processes towards higher level thinking abilities [13]. This is really needed at this time in line with developments in science and technology, including in the world of education. Textbook is also fundamental learning tools and reliable sources of information for students when they acquire new knowledge, improve pedagogy and effective learning [14] including achieving analytical abilities.

Students' analytical abilities can be improved by providing textbooks that can engage them in interesting thinking processes. This is in line with the opinion of Winarno et al [15] who state that the way to foster students' analytical thinking skills is by providing textbooks that have characteristics that direct students to think about solving problems, thinking critically and thinking comprehensively. In textbooks it is necessary to prepare questions that address

students' analytical thinking abilities. In this way, students are conditioned to use their abilities to solve problems.

The important essence of the results of this research is that students' analytical thinking skills improve with the implementation of the case-based Biology Learning Planning textbook. It can be seen that students can easily differentiate between the transition in terminology that occurs from the various components contained in the Lesson Plan in the 2013 curriculum and the Teaching Module in the independent learning curriculum. Students develop analytical thinking skills in writing down the various components needed to prepare learning plans. This writing ability is getting better, this is in line with the research results of Khoridah, et al in 2019 which states that writing ability can improve well through improving students' analytical thinking abilities [16].

The increase in analytical ability reached 18.51% compared to the primary class with the control class, indicating that the effectiveness of using case-based Biology Learning Planning textbooks is included in the good and effective category. Therefore, in the next learning process it is recommended to implement this textbook in learning process. This is in line with efforts to improve the quality of learning that is oriented towards students' higher-level thinking abilities.

## 4 Conclusion

Implementation of the case-based Biology Learning Planning textbook can significantly increase students' analytical thinking abilities. Students who use textbooks as a result of development improve their analytical skills, components in preparing biology learning plans can easily adapt to changes in the current curriculum and the curriculum that will be implemented, namely understanding the term Lesson Plan in the 2013 curriculum into Teaching Modules in the independent learning curriculum.

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