Achievement of Students’ Concept Mastery through Concept-based Learning and Drill Methods in Biology Instructional Methodology Course

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Abstract. This research aims to determine the achievement of students' conceptual mastery in the Biology Instructional Methodology course through concept-based learning and drill methods. Data were collected using post-test questions to 40 pre-service biology teachers. This research is part of previous research, namely research on the development of a concept-based learning model and a drill method. Based on the data that has been collected and analysed, it is known that the achievement of student concept mastery is in the very satisfactory (C +) category with an average score of 64.90.

1. Introduction

The learning models used in the learning process are very varied and have experienced rapid development. Various types of new learning began to emerge along with the times. There are several learning models that can be used in this 21st century, for example time-based blended learning [1], digital game-based learning [2], and team-based action learning [3]. These learning models can be categorized as new and are the result of innovation and creativity of education experts. But apart from that, there are also learning models that are often used, such as discovery learning, project-based learning and inquiry [4].

The availability of various types of learning models does not necessarily mean that all educators always use the available learning models, especially for learning in higher education. If there is, the learning model used is only a simple model or ordinary project-based learning without using syntax, even though the learning model has several advantages when used in class. In science learning, for example, the learning model is very useful in explaining scientific concepts [5].

To obtain a better concept mastery achievement, serious efforts are required during the learning process. One solution that can be used is to combine concept-based learning with the drill method. This combination is expected to provide better results on the achievement of students' mastery of concepts in the Biology Instructional Methodology course. This is because concept-based learning is effective in improving students' conceptual understanding [6] and the drill method has advantages in teaching biology material [7] by conducting repeated training. Thus, the question of this research is how the achievement of the concept mastery of pre-service biology teachers in the Biology Instructional
Methodology course using concept-based learning and drill method. Meanwhile, the purpose of this study was to determine the achievement of concept mastery of pre-service biology teacher by using concept-based learning and drill methods in the Biology Instructional Methodology course.

2. Method
This research is part of the concept-based learning and drill method development research carried out in the Biology Instructional Methodology course. Concept-based learning emphasizes the mastery of students’ concepts regarding the material being studied. The drill method is a learning method that emphasizes the repetition of learning activities. In this study, the learning process emphasized mastery of learning materials assisted by student worksheets which contained problems that must be solved. Students were required to be able to overcome the problems given and find solutions. At each meeting, students were assigned to answer questions that were provided on the worksheet. Besides that, every week, taking turns, there were group that presented the material studied according to the meeting which can be seen in Table 1.

### Table 1. The List of Learning Topic in Every Meeting

| Meeting | Topic                                      | Individual Assignment | Group Assignment |
|---------|--------------------------------------------|-----------------------|------------------|
| 1       | Introduction                               |                       |                  |
| 2       | Learning Theory                            | ✓                     | Group 1          |
| 3       | Biology Learning Experience and Material    | ✓                     | Group 2          |
| 4       | Learning Approach                          | ✓                     | Group 3          |
| 5       | Learning Method                            | ✓                     | Group 4          |
| 6       | Learning Model I in Biology Teaching       | ✓                     | Group 5          |
| 7       | Learning Model II in Biology Teaching      | ✓                     | Group 6          |
| 8       | Teachers’ Basic Skill                      | ✓                     | Group 7          |
| 9       | Psychology Aspects in Learning             | ✓                     | Group 8          |

At each meeting, students were given individual assignments to answer the available questions and solving the problems given to produce solutions and to overcome the problems that have been listed in the worksheet. Apart from individual assignments, there were group assignments. Students were divided into 8 groups. Each group presented one of the 8 topics that have been determined in Table 1. For example, at the 2nd meeting which discussed the topic of learning theory, all students were required to answer questions on the worksheet on the topic of learning. Also, group 1 was assigned to presenting the topic of learning theory to other students. The type of assignment of each meeting is depicted in Figure 1.

After implementing the concept-based learning and drill method, students were given tests according to predetermined indicators. The data were analyzed simply by calculating the class average. The value of effectiveness is only determined based on the achievements of the university and the assessment standards set by the university. The university assessment benchmarks in question are A (Excellent, score range: 86-100), A- (Extremely Good, score range: 81-85), B+ (Very Good, score range: 76-80), B (Good, score range: 71-75), B- (Fairy Good, score range: 66-70), C+ (Very Satisfactory, score range: 61-65), C (Satisfactory, score range: 56-60), C- (Quite Satisfactory, score range: 51-55), D+ (Poor, score range: 40-50), and E (Fail, score range: less than 40). The number of samples was 40 pre-service biology teachers at Padang State University (Universitas Negeri Padang).
3. Results
Data collection was carried out through post-test of concept mastery questions regarding topics that have been learned in class. Based on the data obtained, most students were only able to obtain scores in the range 65-70 (see Figure 2). Based on the data obtained, the highest score obtained by students was 82, and the lowest score was 40. The scores were 68 and 70, respectively, which were obtained by 6 students. Other scores were 66 (obtained by 7 students), 48 (obtained by 1 student), 52 (obtained by 3 students), 54 (obtained by 1 student), 58 (obtained by 1 student), 60 (obtained by 2 students), 62 (obtained by 3 students), 64 (obtained by 3 students), 72 (obtained by 3 students), 74 (obtained by 1 student), and 80 (obtained by 1 student).

Based on the data that has been successfully analyzed, the average posttest score of students after following the concept-based learning and drill method is 64.90 (C+). This value is in a very
satisfactory category. Meanwhile, the lowest score obtained by students was 40 and the highest score achieved by students was 82. Based on the data in Figure 3, it is known that the acquisition of student concept mastery is in the range of 65-70 with a standard deviation of 8.202. The number of students in the posttest after the Concept-based Learning and Drill Method was 40 students.

![Figure 3. The Statistical Descriptive Data of the Post-test](image)

4. Discussion
Biology Instructional Method course aims to equip students in mastering classroom teaching techniques and understanding their theories in depth. Thus, the topics discussed during lectures are topics that are very relevant to the field of teaching in the classroom which consists of strategies, methods, approaches, and learning models in biology lessons. In biology lessons, four main components must be mastered by students, namely the scientific process, scientific knowledge, scientific attitudes, and mastery of technology [8]. With this goal, prospective biology teacher students must understand the four components in biology subjects, so that they can apply the right strategies, approaches, methods, and learning when teaching biology material in schools.

During the learning process, students are directed to master the learning theory (at the second meeting). This topic is very useful for prospective biology teachers because students are trained to develop their mindset to recognize the types of learning theory from various perspectives such as cognitivism, behavioristic and social learning perspectives [9]. Given the insight into learning theory, students are expected to be able to explore every aspect of improving the quality of learning biology in the classroom based on various main perspectives in learning. Furthermore, this course students are also required to master various aspects of biology learning such as the learning experience of biology, learning materials used during the learning process, learning approaches, learning methods, and learning models. Through the various concepts studied, prospective biology teachers are expected to
be able to apply them in the field by paying attention to the quality of learning and overcoming various problems that arise.

Another topic discussed in this course is the basic skills of teachers to teach. Through this topic, prospective biology teacher students are trained to be able to find out the basic skills that teachers must have, for example, skills to open learning, skills to master material and ask questions, skills in managing classes and interacting with students, skills in allocating time and skills to close learning [10]. Additional topics that are also very important in this course are the psychological aspects of the learning process. The psychological aspect is one of the most important aspects because this psychological aspect indicates a trade-off between memory, influence, and causal behavior so that it can predict the causes of reciprocity between individuals with their environment [11].

The importance of various topics in this subject requires pre-service biology teachers to really master all topics. Therefore, Concept-based Learning and Drill Method are used in this course as an effort to make students understand all topics. However, from the results of the posttest given, it is known that student achievements are only in the very satisfactory category. This shows that the achievement of this pre-service biology teacher is still at a moderate level. Several factors can be the reason why learning with the concept-based learning method is not optimal. Some of the causes that can be directly observed during learning are that the discussion method is sometimes less effective [12]. However, concept-based learning needs to be considered as one of the models used in the classroom because it has advantages in deepening students' mastery of concepts [13].

The Drill Method is an activity that is also given during lectures because the Drill method is quite efficient and provides opportunities for students to learn the basics of a concept in a course [14]. However, after being tested on pre-service biology teachers, the results were not optimal. These results need to be studied more deeply or tested again several times to get better results. Overall, Concept-based Learning and the Drill Method make prospective teacher students master the concept in the very satisfactory category which means it is good enough. However, it needs to be investigated further whether this method can provide better results.

5. Conclusion
The concept-based learning model and the Drill method have several advantages in the learning process such as training students in answering the questions provided on the worksheet. This encourages students to study both independently and in groups. With a combination of these two methods, students are trained to learn individually to deepen each topic studied independently and find solutions to various problems given to train their mindset in answering questions. Group assignments also give students the responsibility to master certain topics by providing explanations to other students through the presentation method. Based on the combination of these methods that have been implemented in the Biology Instructional Method course, the achievement of students' mastery of concepts through the concept-based learning and drill method in this class is in the C+ or very satisfactory category.

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