

Research Article

Assessing the Concept Understanding Abilities of Prospective Biology Teachers

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This study aimed to identify the levels of understanding of prospective biology teacher students on the concept of invertebrates based on the cognitive process dimensions of Bloom's Taxonomy. The method used in this research was descriptive qualitative. This research was conducted on 15 prospective biology teacher students. The instrument used was a multiple choice concept mastery test. Based on data analysis, the average cognitive ability of students is 69.10. The acquisition of conceptual understanding based on the dimensions of cognitive processes includes C1: 74.69; C2: 73.67; C3: 57.34; C4: 56.08, and C5: 22.34. The average score of cognitive ability showed that students' cognitive abilities were still below the criteria for completeness set in the invertebrate zoology course.

Keywords: assessing, concept, understanding, abilities, prospective teachers, biology

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1. INTRODUCTION

Understanding the concept is a very important aspect in learning, because by understanding the concepts, students can develop their abilities in each subject matter [1]. Concept understanding consists of two words namely understanding and concept. Concepts are ideas that are used or allow someone to group objects together. Concept understanding is the ability to behave, think and act aimed at students in understanding the definitions, special meanings, nature and core/content of what they learn [2].

Understanding the concept or mastery of knowledge is an important factor in determining the success of students in pursuing their studies. The knowledge possessed by students becomes the basis for the formation of other abilities. Attitude and skill competencies will be developed if students have sufficient conceptual understanding as the basis for forming these abilities.

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One of the concepts in biology subjects that is often encountered in everyday life is Invertebrates. Invertebrate zoology tends to be considered as a subject that tends to be neglected than vertebrates, even though invertebrates actually have an important role in ecology beyond the scope of vertebrates [3]. In studying Invertebrates themselves related to existing ecosystems, research suggests that ecosystems and invertebrates influence each other in the level of diversity and distribution of these invertebrates [4]. This is why it is important for prospective teachers to understand and reflect on invertebrate learning in an environment/ecosystem that is directly included in the scope of life.

Invertebrate zoology is the study of animals without a backbone. Invertebrate habitat includes water, as well as land with a variety of body sizes. Some invertebrates are free-living and some are parasitic. Invertebrates are often encountered in everyday life, such as the Papua area which is familiar with malaria, where the cause is *Plasmodium* sp. There is also a sago caterpillar as an animal that is the main food for the Papuan people. Insects are one of the invertebrate animals that we often encounter in everyday life and are important to study. The deepening of invertebrate material at universities refers to the outlines of the Invertebrate Zoology lecture with a brief description: The material in the Invertebrate Zoology Course includes a discussion of the classification, anatomical structure, morphology, physiology and ecology of animals classified in the Invertebrate class ranging from Protozoa, Porifera, Coelenterata, Mollusca, Vermes, Arthropoda, and Echinoderms.

Understanding the concept of a science plays an important role, one of which is to connect or link one concept to another that has been studied. Therefore, the ability to understand concepts is one of the important goals in learning. Understanding the concept provides an understanding that the material being taught is not just a rote [5]. Concept understanding cannot be transferred completely from the teacher's mind to the student's mind, students must automatically be active in constructing their knowledge.

Mastery of concepts that are necessary for successful learning. In connection with that, students' mastery of concepts is expected to be able to manage learning cognitively so that improvements can be made in subsequent learning [6–8]. The importance of developing mastery of concepts, the fact is that it is not in line with the current conditions of science learning. One of the problems faced in Indonesia is the weakness of the learning process, students are not encouraged to develop their thinking skills, and learning in the classroom is only directed at memorizing information without being required to understand what they remember [9].

Based on the results of field studies that have been carried out, it shows that the learning strategies applied by educators have not facilitated students to improve their mastery of concepts, the learning model still uses lecture and discussion models so that students tend to be bored and passive in learning activities. Mastery of students' concepts is quite low in science learning. This is evidenced by the low value of student learning outcomes. Learning outcomes affect students' critical thinking skills and mastery of concepts [10, 11].

Based on the importance of understanding the role of a concept, a study was conducted with the aim of identifying or obtaining an overview of the understanding of prospective biology teacher students on the concept of invertebrates based on the cognitive process dimensions of Bloom's Taxonomy and knowing the obstacles and problems that students face in the knowledge acquisition process, especially in the Invertebrate Zoology course.

2. RESEARCH METHOD

This research was conducted in the Biology Education Study Program. The implementation time is in odd semesters. The research subjects were 15 students who took the Invertebrate Zoology course. This research is a qualitative research that aims to explain the phenomenon of problems experienced by students in understanding abstract concepts. Research data in the form of cognitive ability test results were analyzed descriptively and qualitatively.

Data was collected through cognitive ability tests based on ability levels on Bloom's taxonomy from levels C1, C2, C3, C4, and C5 and interviews with students. The research data are then analyzed and compared with predetermined success indicators. The parameter used to see the achievement of understanding this concept is used the achievement parameter based on the learning completeness score in the Invertebrate Zoology course, which is 75.

3. RESULT AND DISCUSSION

This research was conducted by testing the cognitive ability of prospective biology teacher students on Invertebrate Zoology. The following presents the data on the results of the concept understanding test based on the dimensions of cognitive processes from levels C1, C2, C4, C4 and C5. Figure 1 shows the understanding of students' concepts based on the dimensions of cognitive processes.

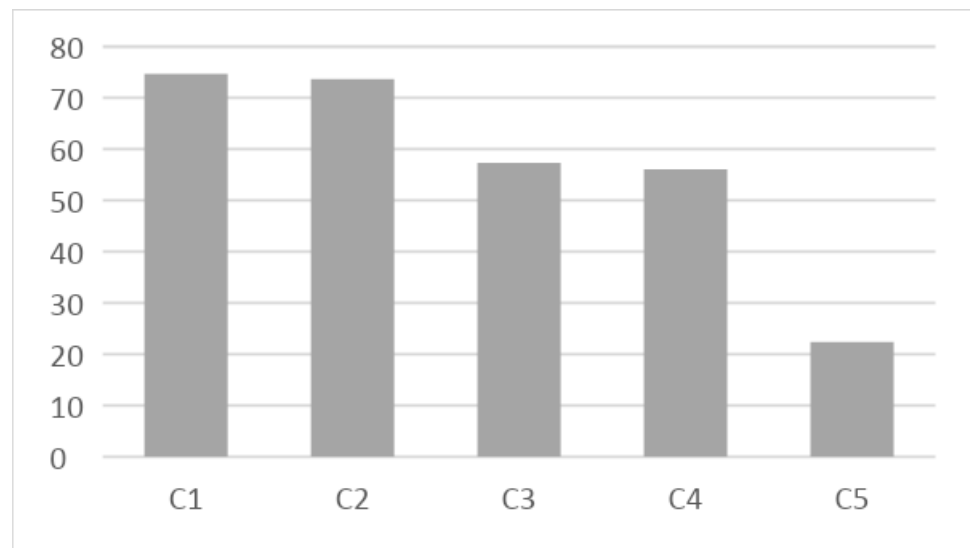


Figure 1: Students' cognitive abilities based on the dimensions of their cognitive process.

Figure 1 above illustrates the understanding of the concept (cognitive) of prospective biology teacher students. Of the five levels of process dimensions measured, mastery of concepts at levels C1 and C2 has the highest achievement, followed by abilities at levels C3 and C4 and finally at level C5. The data in Figure 1 shows that students still have difficulty in mastering the level of cognitive process dimensions at level C5.

The results showed that students still had difficulty mastering the dimensions of cognitive processes at levels C3, C4 and C5. The thought process occurs when a person takes new information and information stored in memory and then connects the two information or rearranges and expands the information to achieve goals in confusing situations. The thinking process will be more complex if it requires students to connect, analyze, make inferences from the phenomena being studied. Cognitive processes at a high level require abstract thinking skills, so that if students have difficulty solving cognitive problems at these three levels, it indicates that students' abstract thinking abilities are still low.

The results of interviews with students showed that students had difficulty solving questions at levels C3, C4 and C5 because the previous students were not used to working on these questions, so they found it difficult to solve the questions. The learning experiences that students experience, especially in Invertebrate Zoology lectures also affect students' thinking abilities. The student learning experience still tends to use a one-way learning model that is centered on the lecturer so that it does not direct students to develop their thinking skills.

The thinking process from level C3 to C5 is included in complex thinking. The three aspects are application aspects, application analysis aspects and evaluation aspects

[12]. Applying involves using a procedure to solve a problem or perform a task. Cognitive processes in applying include running and implementing [13]. Analyzing includes the ability to parse a problem or object into its elements, cognitive processes in analyzing include distinguishing, organizing, and finding implied messages (finding the point of view, bias and purpose of a form of communication) [13]. Evaluating is making a judgment based on existing criteria and standards. The cognitive process in evaluating includes checking (testing) consistency or lack of a work) and criticizing (assessing a work both its strengths and weaknesses) [13].

Complex thinking skills require students to relate information, describe the information obtained, make judgments about the information obtained and produce new information based on the information obtained through a learning process. The information provided but not in complete condition will make it difficult for students to relate one information to another. The acquisition of knowledge is also influenced by the learning experiences experienced by students. In principle, the learning experience should enable student involvement in the learning process. The results of interviews with several students reveal information about the learning process where students are not required to obtain broader and deeper information. Students only get information from the lecturer during the learning process and during that time students only focus on information from the lecturer without being required to expand the information and deepen the material they are learning. Partially understood information will make it difficult for students to carry out complex thinking processes.

Suparno[14] states that knowledge must be constructed by students themselves through the learning experiences experienced by students, so it is important to involve students in understanding concepts [14]. NRC (2013) states that one of the standards in science learning is inquiry. Inquiry is a learning experience that can be done by lecturers in order to build student knowledge [15]. Learning experiences with inquiry, one of which is inquiry dialogue, will help students construct the knowledge required during the learning process. Learning with inquiry can strengthen students' abilities in carrying out various cognitive processes [16]. The experience of making observations, identifying problems, designing experiments, collecting data and analyzing data allows students to gain experience in acquiring knowledge that is constructed naturally. Learning by using dialogue inquiry can develop students' conceptual understanding and develop students' thinking skills in developing a number of basic abilities that are important for students to have.

4. CONCLUSION

Based on the research results, students' cognitive abilities on Invertebrate Zoology material are still relatively low, especially in the dimensions of cognitive processes C3, C4 and C5. Students still find it difficult to develop thinking processes, especially at the level of complex thinking skills, such as analyzing, applying and evaluating. The three thinking processes require students to be able to connect a lot of information and this becomes a separate obstacle for students. Student learning experience is an important factor in the success of students in shaping their knowledge or developing understanding of concepts so that lecturers must start designing learning that can facilitate students to build their understanding.

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