



The Reflective Thinking Skills of Prospective Teacher on Invertebrate Zoology Course

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ABSTRACT

The purpose of this study was to explore the reflective thinking skills of students as prospective teachers in the invertebrate zoology course through an analysis of the learning process of the literature provided during lectures. The research method used was the case study of the invertebrate zoology lecturing process. The instruments in this study were observation sheets, task analysis used in lectures, and a questionnaire about students' perceptions of lecture activities. The results showed that the Invertebrate Zoology lectures only focused on concepts or theories and did not provide reflective thinking skills. Therefore, Zoology lectures have not shown a balanced mastery of concepts and reflective thinking skills.

Keterampilan Berpikir Reflektif Calon Guru pada Mata Kuliah Zoologi Invertebrata

ABSTRAK: Tujuan penelitian ini adalah untuk menggali kemampuan berpikir reflektif mahasiswa calon guru pada mata kuliah zoologi invertebrata melalui analisis proses pembelajaran hingga analisis literatur yang diberikan selama perkuliahan. Metode penelitian yang digunakan adalah studi kasus terhadap proses perkuliahan zoologi invertebrata. Instrumen dalam penelitian ini adalah lembar observasi, analisis tugas yang digunakan dalam perkuliahan, angket tentang respon mahasiswa terhadap kegiatan perkuliahan. Hasil penelitian menunjukkan perkuliahan zoologi Invertebrata yang di berikan hanya fokus pada konsep atau teori dan tidak memberikan keterampilan berpikir reflektif. Artinya, perkuliahan zoologi belum menunjukkan bekal penguasaan konsep dan kemampuan berpikir reflektif yang seimbang.

INTRODUCTION

Education is a way to produce independent, qualified, and confident human resources to face the dynamics of development in the 21st-century globalization era (Meilia & Murdiana, 2019). Employment requires humans with higher-order thinking skills, including

communicating, creating new ideas, and collecting and analyzing information (Tanjung & Aminah Nababan, 2019). Analyzing information is one of the abilities that underlie the realization of higher-order thinking skills; therefore, it needs to be developed (Barron & Chen, 2008 ;Nugroho et al., 2019). Education has an important

role in the progress of a nation. Along with the development of education, which is in line with technological advances, it is necessary to balance the ability of the main actors in education, namely teachers (Pujianingtias et al., 2019). Building effective and reflective teacher competencies needs to improve professional abilities and skills. Higher-order thinking skills must also be improved to obtain a better education (Jatmiko, 2018).

Based on the description and the times, the demand for education has become the primary subject. One of the methods is to produce prospective teachers with pedagogical abilities and higher-order thinking skills. Therefore, higher education institutions need a clear emphasis on lectures emphasizing transforming basic thinking into complex thinking (Juliantari, 2018). One of the skills that a prospective teacher must possess is reflective thinking skills. Providing reflective thinking skills to prospective teachers should be of greater concern in improving the quality of education.

Rodgers discusses Dewey's opinion on reflective thinking skills in depth. Reflective thinking must meet four criteria, namely (1) reflection is a meaningful process of bringing someone from one experience to another with a deeper understanding of the relationship between one experience to the next; (2) reflection is a systematic, thorough, and disciplined thinking process rooted in scientific inquiry; (3) reflection must occur in a community by interacting with other people; and (4) reflection requires an attitude of respect for the personal and intellectual development of self and others (Carol, 2002; Vevy & Rahmalia, 2020). The positive values reflected in reflective thinking skills are applied in the education of prospective teachers. It will form a positive attitude that affects the students they will teach later (Agustan, 2017).

One of the challenges of education in Indonesia today is learning in schools. Learning is generally performed using a one-

way method, namely lectures. In teacher-centered learning, students tend to memorize the material; thus, they do not reflect the knowledge received with the basic knowledge they initially have (Novitasari, 2018). Teachers must have reflective thinking skills to create more quality and meaningful learning. Also, the skills are needed to improve students' reflective thinking skills. The higher-order thinking skills cannot develop without explicit and deliberate effort (Ratnasati & Nurhidayah, 2020).

The role of the teacher in learning is undeniable. It can be said that one of the important factors for success depends on the role of the teacher. One of the important factors in improving science teachers' performance (biology) is the process of preparing science teachers (Istiana et al., 2020).

Departing from this fact, efforts to increase prospective teachers' quality must continue to be carried out. Invertebrate Zoology is one of the courses that need to be taken by prospective biology teachers. This course is a provision for prospective teachers to learn at the senior high school level on Animalia material. This course talks about the life of animals, especially those without a backbone. Invertebrates are animals that belong to the type of animal that does not have a backbone. Invertebrate animals are divided into groups; Protozoa, Porifera, Arthropoda, Platyhelminthes, Nematelminthes, Annelida, Coelenterata, Mollusca, and Echinodermata (Rachmawati et al., 2021). Invertebrate is a term expressed by Chevalier de Lamarck in denoting animals that do not have a backbone. Invertebrates are the largest class group (Hernawati, 2017). In addition to not having hard internal bones, invertebrate groups are generally soft-bodied and have a hard exoskeleton to protect their bodies. Invertebrates comprise about 97 percent of all members of the Animalia kingdom (Maria, 2016).

Invertebrates show high reproductive and developmental patterns diversity, far exceeding vertebrate animals (Herna, 2021). All vertebrates are deuterostomes because the division occurs radially and intermediately, and the mouth is not formed from the blastopore (Michael, 2017).

Several studies have shown that Invertebrate Zoology lectures are taught conventionally (Riki, 2014; Agus et al., 2021; Nugroho, 2018). It is necessary to develop higher-order thinking skills, such as reflective thinking skills, so that students, as prospective teachers, can improve their understanding. Therefore, this study aimed to obtain an overview of the reflective thinking skills of prospective biology teachers in the Invertebrate Zoology course. In studying invertebrates related to existing ecosystems, research suggests that ecosystems and invertebrates influence each other in the level of diversity and distribution (Nuria et al., 2012). Therefore, prospective teachers need to understand and reflect on invertebrate learning in an environment directly within the scope of life.

METHOD

The method used in this research was the case study to capture the real situation during the teaching and learning process of the Invertebrate Zoology course. The participants in this study were students as prospective biology teachers in 2016, which consisted of 30 students attending the Invertebrate Zoology course at one of the State Universities in Jayapura. The focus of observation in this case study was to analyze reflective thinking skills and reveal students' responses to Invertebrate Zoology lectures. The instruments used in this study were observation sheets, student response

questionnaires, and a collection of assignment documents during the lectures. The observation sheet covered the learning processes with reflective thinking skills as the focus. Student response questionnaires about lectures generally described the lecture process carried out. The assignment document contained all forms of assignment by the lecturer, which were then analyzed to describe the development of students' reflective thinking skills.

RESULTS AND DISCUSSION

Invertebrate Zoology is a compulsory course that needs to be taken by students of the Biology Education Study Program at the university where the research was conducted. The Invertebrate Zoology course has three credits, consisting of two theoretical credits and one practical credit. The topics of the invertebrate zoology theory consisted of nomenclature and terminology, Phylum Protozoa, Phylum Porifera, Phylum Coelenterata, Phylum Platyhelminthes, Phylum Nematelminthes, Phylum Annelida, Phylum Mollusca, Phylum Arthropoda, and Phylum Echinodermata. Practical activities were carried out during one meeting after students finished attending lectures and the final theoretical exam. Practicum was done in groups. Interviews with the lecturers revealed that this course was conducted using lecturing and question-and-answer methods.

The observations were carried out in three meetings, which covered the nomenclature of Phylum Protozoa, Phylum Porifera, and Phylum Coelenterata. The lecture activities only led to the delivery of knowledge to students. A few led to reflective thinking skills.

Table 1. The Analysis of Lecture Activities on Thinking Skills

Activities	Thinking Skills
Topic: Phylum Protozoa	-
• The lecturer made an apperception about the amoeba.	-
• The lecturer delivered material using the lecturing method interspersed with questions and answers.	-

Activities	Thinking Skills
<ul style="list-style-type: none"> The lecturer conveyed an overview of malaria and asked, "Can anyone explain malaria and its cause?" 'DS' answered that malaria is a disease caused by <i>Plasmodium</i> sp, an example of an animal from the Sporozoan class of Phylum Protozoa. Malaria is still an endemic disease in Papua. Malaria causes red blood cells to be damaged, so it tends to cause anemia. It spreads through mosquito bites carrying the plasmodium parasite. At the end of the lesson, the lecturer gave assignments to students to be collected in the following week. Lecturers used LCD projectors as a learning medium. 	<ul style="list-style-type: none"> - Relevance between knowledge of plasmodium and basic knowledge of malaria. - -
Topic: Phylum Porifera	
<ul style="list-style-type: none"> The lecturer performed an apperception about Protozoa. The lecturer delivered material using the lecturing method interspersed with questions and answers. The lecturer displayed pictures of 3 sponge body shapes and asked, "Can anyone explain the difference between the three types of Porifera body shapes." 'R' answered three types of body shapes, specifically the water channel types. The three types of canals are asconoid (simple, the direction of flow is through the intake channel-spongocoel then osculum), Syconoid (the shape is folded outward with the shape of a radial channel. The flow direction starts from the dermal axis to the inlet channel and then prosophyll-radial channel-spongocoel-osculum), and Leuconoid type (irregular, has a more complex flow direction compared to the other two types) At the end of the lesson, the lecturer provided opportunities for students to ask questions; however, no students asked any questions. The lecturers used an LCD projector as a learning medium. 	<ul style="list-style-type: none"> - - - Give quite complete information (Precision) - -
Topic: Phylum Coelenterata	
<ul style="list-style-type: none"> The lecturer performed an apperception by showing pictures of several animals in the phylum Porifera and Coelenterata. The lecturer delivered material through the lecturing method interspersed with questions and answers. At the end of the lesson, the lecturer provided opportunities for students to ask questions; however, no students asked any questions. The lecturers used an LCD projector as a learning medium. 	<ul style="list-style-type: none"> - - - -

The results of the analysis can be seen in Table 1. Table 1 shows that indicators of reflective thinking skills were observed, but the lectures were limited to only the delivery of theories. Reflective thinking activity could not be identified in the topic of phylum protozoa. The reflective thinking activities only appeared after listening to the lecturer's discussion about protozoa. Reflective thinking activities appeared in the relevance indicator when 'DS' answered questions from the lecturer. The questions asked by the lecturers were about malaria, which is endemic to the students'

environment, so that they reflect the knowledge they have received with their basic knowledge about malaria. The students had the basic knowledge of the symptoms and spreading method. The initial knowledge was then connected to their newly received knowledge about *Plasmodium* sp.

However, in the process, lecture activities were focused on a one-way model that did not direct reflective thinking skills. On the topic of the Porifera phylum, students' reflective thinking was identified after discussing with the lecturer even a

small part of the overall material on the topic of the Porifera phylum. This information can be seen from the 'R' answers to questions from the lecturer. He explained in more detail three types of channels in the phylum Porifera. However, it could not be determined whether the student explained the answer by reflecting on his understanding of the material or simply repeating what he had learned.

The third observation on the Coelenterata phylum strengthened the previous finding that the learning process only emphasized the delivery of theories and did not lead to students' reflective thinking skills. There were two indicators of reflective thinking observed, namely relevance and precision. Only two students were actively involved in reflective thinking skills activities during three observations.

Based on the overall observation, the lectures only emphasized knowledge (theories) that students must understand. There was no visible activity of reflective thinking skills. The method used by the lecturer was lecturing and question and answer assisted by PowerPoint slides displayed via an LCD projector. There were only two active students out of the total students. The analysis of reflective thinking skills was also confirmed using an assessment used by lecturers during the Invertebrate Zoology course. The assignments and quizzes the lecturer gave directed students' cognition but did not emphasize developing students' reflective thinking skills.

Table 2. The Analysis of Assessment

Questions	The Cognitive Domain
• Protozoa are divided into how many classes? Explain and give an example of each class!	C1
• Explain how many kinds of pseudopodia are in the Sarcodina class!	C2
• Explain the difference between polyp and medusa in Coelenterates!	C2
• Describe each class of the phylum Platyhelminthes and give an example!	C2
• Give examples of parasitic worms and their hosts on Nematodes!	C1
• Show pictures of the Mollusca evolution tree, starting from the lowest class to the highest class!	C1
• Gastropod is divided into how many subclasses, name and give an example of each!	C1
• In Papua, there are several species of giant clams. Please mention the species you know!	C2
• Echinoderms consist of how many classes? Name and give an example of each class!	C1
• Explain with pictures the difference between Chilopoda and Diplopoda!	C2
• Describe the types of mouth types of insects or Hexapoda.	C2
• What is known about a) proboscis, b) elytra, c) ovipositor, d) biramous, and e) trachea?	C1

The analysis of the questions showed that the questions led to students' knowledge, and the average was at the C1 and C2 levels. The types of questions used were more demanding for students to understand and repeat what they have learned. Nothing directed students to reflect on what they had learned with their basic understanding. Neither represents the development of higher-order thinking skills. This finding strengthened the

previous finding that learning only emphasized material understanding that students need to understand, without a balance between knowledge and reflective thinking skills. The learning only focused on basic thinking skills, such as remembering or memorizing facts and then expressing them. This problem may also be experienced at several universities in Indonesia because the learning activities carried out are demonstrations and

teacher-centered. Besides, the non-optimal implementation of lectures is because there are still many lecturers who use verifiable lecture strategies so that they do not train students' thinking skills (Rahayu & Winarso, 2018).

Hafni explains that most of the learning in higher education is still taught with a traditional approach (Riki, 2014). To maximize lectures at universities, especially in Papua, lectures should be oriented to the development of thinking skills, either through inquiry (investigation) which directs students to find and understand the knowledge they have learned for themselves or through problem-solving, at least some thinking skills, namely critical, creative, and reflective thinking skills (Rositawati, 2019).

Students' perceptions of the Invertebrate Zoology course was positive response since they liked the course based on the perception questionnaire filled by the students. They expressed interest (65%) in the courses. Students stated that invertebrate zoology lectures were useful to improve their competence as teachers later, and this course was useful as a provision for them during work or to continue their higher studies. However, the lectures did not accommodate students to improve their competence and did not lead to thinking skills.

Reflective thinking skills are one of the skills that prospective teachers must develop. Dewey claims it is a type of high-level thinking that is active, sustainable, and conscientious of knowledge-based beliefs (Fisher, 2004). Chen supports Dewey's opinion through his findings that

reflective thinking is necessary and important because it encourages further learning and improves other thinking skills (Chen et al., 2019). Lipman discovers that a reflective situation is where students are moved to think about problems or phenomena that exist in nature (Lipman, 2003). The learning fostered curiosity and showed the relationship between learning materials through community and social interactions. Reflective thinking skills are important to be applied in education to produce quality individuals who can reflect their understanding according to the situation.

CONCLUSIONS AND SUGGESTIONS

Invertebrate zoology lectures only emphasized students' understanding or cognitive skills, not providing reflective thinking skills. Therefore, the Invertebrate Zoology course did not show a balance between knowledge and higher-order thinking skills, especially reflective thinking. Observation of three topic activities showed that students were not provided with reflective thinking skills. They tended to focus on the material that they must receive. Students showed a good interest (65%) in the Invertebrate Zoology course. They stated that the Invertebrate Zoology course was useful in increasing their competence as teachers and as a provision for them to continue to a higher education level.

Based on the results of the analysis of reflective thinking skills of prospective teachers in the Invertebrate Zoology course, it is necessary to research to develop reflective thinking skills using student-centered learning methods.

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