# The Analysis of Concepts Mastery and Critical Thinking Skills on Invertebrate Zoology Course

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**Abstract:** ***This study aims to provide an overview of concepts and mastery of critical thinking skills of students in classes taught Invertebrate Zoology conventionally (no or minimal inquiry). Subjects were students of the College of Teacher Training and Education (STKIP) PGRI West Sumatra and Riau Islamic University students (UIR) Department of Biology Education (5th semester and 7th semester), who have taken courses Invertebrate Zoology (on average students take courses Invertebrate Zoology in 3 semesters). Samples were taken randomly as many as 130 people (55 people for critical thinking test consisting of 30 students and 25 students UIR STKIP and 75 people for concept mastery test consisting of 45 students and 30 students UIR STKIP). Mastery of concepts and critical thinking skills of students captured through the test. The results showed that the mastery of concepts and critical thinking skills of students UIR and STKIP PGRI on Invertebrate Zoology some lecture material, which includes 3 phylum (Aschelminthes, Annelids, and Molusca) is still relatively low, ie mastery of concepts and critical thinking skills of students UIR row are 48 and 49, while the mastery of concepts and critical thinking skills of students STKIP PGRI respectively 45 and 49. From these results can also be explained that the concept can not be stored long given in memory of the student , and therefore required the lecture -oriented experience and able to train critical thinking skills of students, the lecture is fitting is the process of inquiry -based laboratory lecture.***

**Keywords:** Mastery of concepts, critical thinking skills, invertebrate zoology.

## 1. Introduction

Invertebrate Zoology is the study of the science that describes specifically about the ins and outs of animal life, in particular that does not have a spine. Invertebrate Zoology lecture is an activity that directs students to learn how to observe the species, identifying the characteristics and a property of each species, species classify, arrange the hierarchy of each species, explains the differences in the characteristics of each phylum and determine the role of invertebrate species for sentient life other.

Lectures Invertebrates also a basic lecture, which in translation is done in the implementation which includes morphology, anatomy, physiology, and ecology of animals without backbones. This elaboration is needed to determine what benefits can be extracted from the life of invertebrates, which in turn related to or associated with the development of other branches of biological sciences, such as genetics, biochemistry, molecular biology, and also branch outside the biological sciences. Therefore, to develop or master branch of biology, students are expected to master basic concepts, among others, the concept of Invertebrates, so that the student mastered the concept of Invertebrates can think critically when faced with the problems posed by invertebrate animals, in addition to the student can also explore the animal so it can be beneficial to other living creatures.

Concept by Trianto (2007) is an abstraction of a set of experiences that are defined as a group of objects or events. Abstraction means a process conducted focusing on the person's particular situation by taking certain elements. Klausmeier (1980) asserts that the concept of mental formation in the grouping of words with certain explanations that are acceptable in general. Invertebrates' concepts in the lecture very much at all, and therefore required a variety of skills, namely higher-order thinking skills and science process skills. These skills are useful to facilitate students in understanding the concepts of Invertebrates.

Mastery of the concept can be defined as the ability of students to understand various concepts, both before the process of learning, during the learning process, and after the learning process. Dahar (2003) defined as the ability of student mastery of concepts in understanding scientific meaning, a good concept in theory and its application in daily life. Mastery of the concept is part of the learning outcomes in the cognitive domain. Learning success is not only dependent on the cognitive domain alone, but depends on the environment, learning conditions, and prior knowledge of students. According to West and Pines (1986) study involves the formation of meaning by students of what they do, see, and hear, and therefore required appropriate learning.

Student mastery of concepts influenced by psychological factors, namely factor intelligence, attention, interest, aptitude, motivation, maturity and fatigue (Santrock, 2010). In addition, mastery of concepts students are also influenced by learning strategies. Appropriate learning

strategies can make these concepts can last a long time in the memory of the student. Learning that involves students in hands-on experience, can stimulate thinking skills, can combine in various ways to learn, and includes a variety of domains (cognitive, affective, and psychomotor) is needed in mastery learning concept, and one way is right is lab -based learning. Thus, when a person can master a concept, it is possible he gained knowledge that is not limited. Nurhadi (2004) also explains that the process of learning more interesting and memorable if the child has what is learned and not knows it, so that more students can improve memory. Sudaryanto (2008) adds that the learning approach needed to increase understanding of the material being studied is influenced by the development of mental processes used in thinking and concepts used in the study.

Invertebrates' mastery of concepts can not be separated from thinking skills. Thinking skills required of each person is a high -level thinking skills, which is what determines the success. Galbreath (1999 in Tindangen, 2007) explains that the millennium ( XXI century ) is a knowledge century and the era of globalization that demands toughness . In the century of knowledge required human resources with high quality which has a high -level thinking skills, among others critical and creative thinking (Trilling & Hood, 1999, in Tindangen, 2007). In Invertebrates concepts most dominant than critical thinking skills.

Critical thinking skills by Ennis (1985 ) is a skill or ability of reasoning and reflective thinking that is focused on determining what is believed and what to do. Critical thinking skills include five major groups which is the indicator. The fifth group of indicators that include: first, provide a simple explanation (elementary clarification); secondly, build basic skills (basic support); Third, make inference (inference); fourth, making further explanations (advanced clarification); fifth, set strategy and tactics strategic and tactic). Watson & Glaser (Filsaime, 2008) view of critical thinking as a composite of attitudes, knowledge, and skills. Attitude is always questioned, needed to know where the problem is then the knowledge will be obtained through a valid conclusion in finding and applying skills attitudes and knowledge.

Based on the above explanation, it can be concluded that the mastery of concepts and critical thinking skills are needed to understand and develop concepts of Invertebrate Zoology. Thus the researchers tried to analyze the mastery of concepts and critical thinking skills of students and student STKIP Padang Islamic University of Riau (UIR) Invertebrate Zoology at the lecture. The reason for choosing these two universities is because it has the same characteristics (having a Biology Education department), differences in the ability of students is not too flashy, and a quality of private universities in the respective province ( STKIP located in West Sumatra province and UIR are in RIAU). The results of this study are expected to provide an overview of concepts and mastery of critical thinking skills in college students Invertebrate Zoology.

## 2. Research Methods

This research is a descriptive study, the method used is descriptive quantitative, which describes the distribution of the level of mastery of concepts and critical thinking skills of students in some material lectures Invertebrate Zoology (Aschelminthes phyla, annelids, and molluscs). This research was conducted in STKIP PGRI and UIR in August of 2013 with the entire student population of the Biology Department of Education has taken courses Invertebrate Zoology, ie half semesters 5 and 7, with the number approximately 220 people. The number of samples taken from 130 people, consisting of 55 people to test critical thinking, the division consists of 30 students and 25 students UIR STKIP PGRI and mastery of concepts used to test a sample of 75 people consisting of 45 students and the UIR 30 students STKIP PGRI, using the technique of simple random sampling. To obtain relevant data, the instrument used in this study is a test instrument, which tests mastery of concepts and critical thinking tests.

The test of critical thinking indicators compiled by Ennis (1985). Critical thinking test consists of 33 questions, which is a matter for the phylum Aschelminthes 11, 11 about to phylum Annelida, and 11 questions for the phylum Mollusca, and concept mastery test consists of 50 questions, with 15 questions for Aschelminthes phyla, 15 questions to the phylum Annelida, and 20 questions to the phylum Mollusca. Both of these instruments are designed with multiple-choice form, and critical thinking skills to the instrument, along with the reasons the student answers. Specialized in processing the data, the students answer correctly expressed as a score. Specifically in this study, researchers did not discuss the total score of each student, but the total score obtained by summing across the scores of each student. Scores obtained by students can not describe the actual results, therefore researchers convert the scores into the range 0-100 to obtain the value. Just like scores, researchers do not discuss the value of each student, but the total value obtained by summing all the values of each student. To find the average, the total score and the total value divided by number of students, so that the mean score and the mean value for each phylum can be illustrated more clearly.

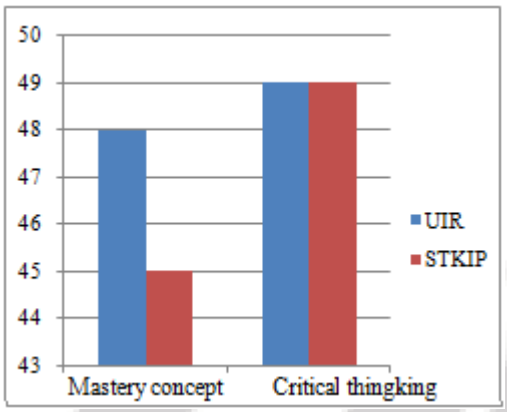
## 3. Results and Discussion

**Table 1**: Concept Mastery Data Analysis and Critical Thinking Skills Student at UIR in Invertebrate Zoology Laboratory -Based Inquiry class

| *Aspect* | *Topic* | *Score* | | *Value/point* | |
|---|---|---|---|---|---|
| | | *Total* | *Mean* | *Total* | *Me-an* |
| Concept Mastery | Aschelminthes | 306 | 6,8 | 2040 | 45 |
| | Annelida | 332 | 7,38 | 2213,33 | 49 |
| | Mollusca | 460 | 10,22 | 2300 | 51 |
| | Total | | | 6553,33 | 145 |
| | Mean | | | 2184,44 | 48 |
| Critical Thinking | Aschelminthes | 147 | 4,9 | 1336,36 | 44 |
| | Annelida | 163 | 5,43 | 1481,82 | 49 |
| | Mollusca | 180 | 6,0 | 1636,36 | 54 |
| | Total | | | 4454,54 | 147 |
| | Mean | | | 1484,85 | 49 |

**Table 2:** Analysis of Student Concept Mastery and Critical Thinking Skills at STKIP in Invertebrate Zoology Laboratory-Based Inquiry class.

| *Aspect* | *Topic* | *Score* | | *Value/point* | |
|---|---|---|---|---|---|
| | | *Total* | *Mean* | *Total* | *mean* |
| Concept Mastery | Aschelminthes | 202 | 6,73 | 1346,67 | 45 |
| | Annelida | 198 | 6,6 | 1320 | 44 |
| | Mollusca | 280 | 9,33 | 1400 | 47 |
| | Total | | | 4066,67 | 136 |
| | Mean | | | 1355,56 | 45 |
| Critical Thinking | Aschelminthes | 126 | 5,04 | 1145,45 | 46 |
| | Annelida | 122 | 4,88 | 1109,09 | 44 |
| | Mollusca | 157 | 6,28 | 1427,27 | 57 |
| | Total | | | 3681,81 | 147 |
| | Mean | | | 1227,27 | 49 |




**Charta 1:** Differences Critical Thinking Skills and Concepts Mastery Students at UIR and STKIP

Referring to the Table and Figure above, it can be concluded that the average overall mastery of concepts for students and student STKIP UIR is still relatively low, namely 48 and 45, it can be described in more detail, namely the average student mastery of concepts to the subject of the phylum UIR *Aschelminthes* is 45, the subject of the phylum *Annelida* is 49, and the subject of the phylum *Mollusca* is 51. As for the average student mastery of concepts STKIP to the subject of the phylum Aschelminthes is 45, the subject of the phylum *Annelida* is 44, and the subject of the phylum *Mollusca* is 47. And for the overall average of students' critical thinking skills and student UIR STKIP also still relatively low at 49. Details the average exposure is critical thinking skills of students to the subject of the phylum UIR Aschelminthes is 44, the subject of the phylum *Annelida* is 49, and the subject of the phylum *Mollusca* is 54. As for the average student critical thinking skills to the subject of the phylum STKIP *Aschelminthes* is 46, the subject of the phylum *Annelida* is 44, and the subject of the phylum *Mollusca* is 57.

The above data show that mastery of concepts and critical thinking skills of students for three phyla are still far from the expected, this can be caused by too much material, so it is difficult to understand. In addition, the planting of Invertebrate Zoology concept does not occur optimally, so that many of the concepts are lost due to lack of involvement and direct experience of the students in discovering and understanding the concepts. The concept will be easily absorbed and stored in the memory, if the students themselves who experience it (search, find, and store), and always stimulated to think critically. If someone already understand the concept correctly, and attached to long-term memory, the critical thinking skills will also increase. From these data the average low is also seen on the subject of the phylum found *Aschelminthes* and phylum *Annelida* (*Poligochaeta* class specific), it is indicated because this material is very difficult, there are species in the phylum less familiar, hard to find the original object, and the most microscopic.

The material is difficult, less familiar, are abstract and can lead to less motivated students to learn. The low student motivation will have an impact on the low low mastery of concepts and higher-order thinking skills of students. Sardiman (2007) describes the importance of motivation, motivation to learn is the overall driving force within that raises student learning activities, which ensures continuity of learning activities and gives direction to the learning activities, so that the desired destination by studying a subject that can be achieved. Motivation and learning outcomes, which in this case is measured from the mastery of the concept are the two things that affect each other. Mastery of a concept is crucial to the success of the learning process (Aziz and Jair, 2009).

Concluded the cause of the above phenomenon is due to more students like lectures if faced with the original object, or at least they know the shape of the species. In Aschelminthes and annelid phylum material (especially *Polychaeta* class ), species are generally found microscopic and rarely found, and although found, some expert or some universities in Indonesia rarely make specimen, so that the lecture was not running optimally

Difficulties encountered, is a matter that must be addressed. Educators should be able to figure out how to handle it, and it can begin to use strategies appropriate lectures. The use of appropriate strategies is the use of a strategy that is able to direct the students to be more active, motivated, able to stimulate critical thinking skills, and based on experience, can be affirmed that the ultimate goal is the training and increased mastery of concepts and

critical thinking skills of students, therefore the strategy deemed appropriate to address these problems is the use of strategies that are based classes or rather inquiry labs. Implementation of inquiry laboratory can stimulate students' motivation to learn more about the life of the species. Exercising their practicum must be supported by the object of life, preservation, and preparation, if not met, and then the implementation educators should provide the media (video or picture). Implementation would be optimal, if the combination of live objects, preservation, preparation, and the media, so the inquiry labs can run perfectly.

Implementation of lectures by using a laboratory inquiry has many benefits, namely the Son and Sri Redjeki (2013) in his study said that college Invertebrate Zoology inquiry-based science labs can increase positive attitude. Tessier (2010) in his study also states that the implementation of inquiry-based laboratories can improve the attitude of a student, give the student a change in thinking about the science they are learning, and help them to improve science learning. Ketpichainarong et al., (2010) in his study also explains that the use of inquiry-based labs to allow students to construct their conceptual understanding, other than that the students were able to apply their knowledge to relevant situations, such as those supported by their ability to formulate and test hypotheses in different situations, and teaching laboratory inquiry may also increase the ability of students to think critically and liveliness.

The above confirms that exposure to overcome many difficulties in the matter, it is difficult to understand, difficult to be stored in long term memory, abstract objects, and microscopic, it takes practice -oriented lectures, to be exact inquiry or inquiry -based lab laboratory . To realize its full potential laboratory inquiry use, it must be combined with a couple of ways or stages, namely (1) the use of live objects are accompanied by preservation, preparation , and video, (2) the submission of critical questions, (3) the answer is evidenced through the lab, and (4) elaborating lab results with existing theories .

## 4. Conclusions and Recommendations

### 4.1 Conclusion

Based on the results of research and discussion, it can be concluded that the mastery of concepts and critical thinking skills of students UIR and STKIP PGRI on Invertebrate Zoology some lecture material, which includes 3 phylum (*Aschelminthes, annelids*, and *Molusca*) is still relatively low , ie mastery of concepts and skills UIR students' critical thinking in a row are 48 and 49, while the mastery of concepts and critical thinking skills of students STKIP PGRI respectively 45 and 49. The low value is indicated for Invertebrate Zoology matter too much, making it difficult to understand, planting concept of Invertebrate Zoology not occur optimally, so that many of the concepts are lost due to lack of involvement and direct experience of the students in discovering and understanding the concepts, the existence of species that are less familiar, object the original is hard to find, and most microscopic.

### 4.2 Recommendation

Educators should be thought of as early as possible and to use strategies that can help college students in finding, understanding, and construct concepts, especially the concept of invertebrate biology, so the concept that they find by experience can be preserved for a long time, and in the end all of these concepts are not lost to useless. The use of the right strategy is to carry out the lecture with student -oriented experience, and is considered the most suitable implementation of inquiry-based laboratory lecture.

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