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# Critical Thinking Ability Analysis Beginning Teacher Candidates Of Biology in the Animal Physiology Material At Biology Education Program Fkip Sriwijaya University

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**Abstract:** ***Preliminary research on the analysis of critical thinking skills in student teachers biological material of animal physiology has been carried out in a country LPTKs South Sumatra Province. The study involved 39 prospective biology teachers force students 2011/2012 on biology education courses. To find out the critical thinking skills of students is done through a multiple choice written test. The data obtained were processed by descriptive. The results showed: the highest percentage of students on the topic of the respiratory system is in observing indicators and consider the results of observations (28.21%); topics shown in the circulatory system focus indicator questions (46.15%), while on the topic of system expenditur /osmoregulation indicators focusing on questions and make induction induction and consider the results (35.89%). In this study it can be concluded that the critical thinking skills of student teachers of biology that focuses on three subjects, namely respiratory system, circulatory system and excretory systems/osmoregulation in general is low.***

**Keyword**: Critical Thinking, Animal Physiology, Biology Teacher Prospective Students

## 1. Introduction

Rapid progress in the field of science and technology requires the availability of qualified human resources, skilled and professional. This is in line with what is stated Moegiadi (2002) that one of the effects of science and technology developments of the 21st century is the education sector. In the world of education, one of the most urgent resource that must be prepared within the framework of the face of the rapid development of civilization is the human resource that teachers. However, there are still complaints from the public at the same criticism that the quality of our teachers at various levels education has not been as expected, that competence is still not satisfactory to the impact of the low quality of education, in addition to other factors (UPI, 2010).

When examined what teachers in implementing educational process in schools is essentially a downstream process, which of course is closely linked to what is happening at the level of the upstream process. Upstream process in question is the educational process experienced by a teacher while studying in institutions that produce future teachers or educational staff. A formal institution directly responsible at the same time has a major task in producing teachers/educators is Workforce Education Institutions (LPTK). Therefore, the existence of public criticism about the low quality of teachers, for LPTK which occupies a leading position in the preparation of future teachers, this should be a material reflection for critically reviewing and clear what is going on during this LPTK.

Directorate General of Higher Education (2008) states that the process of education in LPTK is still much to experience problems, one of which is still weak learning process. Learning is not accustomed to using in-depth approach (deep approach) and a strategic approach (strategic approach) or in other words, learning takes place solely by taking the approach surface is characterized by the dominance of students equipped with the mastery of the subject matter (content) for memorizing and hoard information (rote learning). Therefore, it is not surprising that many students are smart in theory, but poor in the application and problem solving.

According to the Directorate General of Higher Education (2005) one of the reasons why this may happen is as a result of following the students during the learning process, the lecturer did not seek to create an environment that encourages students to develop the ability of thinking (thinking skills). When we refer to the views of Ennis (1991) to prepare teacher candidates who are reliable and professional, then in the process of defense-challenged must be a student who has a habit of thinking (habits of mind), because someone who is smart in thinking would be able and ready to face all the changing times. This is in line with the stated Inch, et al (2006) that the purpose of education should ideally develop mature thinkers who can use their knowledge in real life. This means that the information obtained from the learners in an educational or learning activity has not been said to be the knowledge of the human mind to analyze, apply, synthesize, evaluate, and Integrating instructions to life so that the information can be used for productive purposes, ie making decisions and solve the problem.

One of the thinking skills to prospective teachers should be trained by the time they go through the learning in LPTK is a high-level thinking skills (Higher Order Thinking Skill). According Presse in Costa (1985) higher-order

thinking is a complex thought process, can be grouped into four categories: problem solving, decision making, creative thinking, and critical thinking. Thus, critical thinking is one kind of high-level thinking. Many definitions of critical thinking presented by experts. Gerhard (1971) defines critical thinking as a complex process that involves acceptance and mastery of data, data analysis, data evaluation by considering the qualitative and quantitative aspects, as well as selecting or making a decision based on the results of the evaluation. Furthermore, Ennis (1991) explains the critical thinking is reasonable and reflective thinking that is focused on making decisions about what is done or believed. Makes sense means thinking based on the facts to make the best decision. Reflective means knowingly and expressly seek possible solutions (decision) that focus on the best decisions about what to do. Thus, critical thinking can be used by someone solve life problems faced by people going to succeed in life. Ennis (1991 in Liliasari, 2001) through critical thinking can be used to analyze arguments and bring insight to each of meanings and interpretations; develop a cohesive pattern and logical reasoning; understanding the underlying assumptions and biases of each position; give a presentation model that can be trusted, concise and convincing. Thus, critical thinking can be expressed also significant as one kind of thinking that is convergent, ie thinking that leads to a single point, in contrast to the pattern that is divergent creative thinking, which spread from a point.

On the other hand, Inch et al. (2006) describes critical thinking allows one rationally try to answer questions that can not be answered easily and relevant information is not available. Joane Kurfiss (Inch et al. 2006) defines critical thinking as a study that aims to assess a situation, phenomenon, question, or problem to obtain a hypothesis or conclusion that integrates all available information. A person who thinks critically about a problem is not going to be satisfied with a solution that is clear or obvious, but will suspend judgment with finding arguments, facts, and relevant reasoning's that can support good decision-making. In other words, the critical thinking including a complex process and if done properly will help in assessing complex ideas systematically, both the problem areas of science and social issues.

Inch et al, (2006) further explained that there are eight functions that are interconnected in critical thinking, namely: questioning the problem, formulate goals, lack of information, assumptions, concepts, viewpoints, interpretations and conclusions, as well as the implications and consequences. On the other hand, Costa (1985) previously mentioned that characterize a person who has the ability to think critically, among others: able to detect differences in information, was able to collect the data for factual evidence, is able to identify object attributes (such as the nature, form, etc.), able to register alternative solutions, alternative ideas, alternative situations, able to make a connection between a sequence of problems with other problems, is able to draw conclusions and generalize from data coming from the field, being able to make predictions of the available information, is able to classify information and ideas, is able to interpret and create flowcharts, able to analyze the content, principles and relationships, is able to compare and contrast the contrast, and able to make a valid conclusion. Previously, Ennis (1991) describes critical thinking skill indicators divided into five groups: (1) provide a simple explanation (elementary clarification) consists of three sub-abilities: (a) formulating the problem; (b) analyze the arguments; (c) ask and answer questions; (2) build basic skills (basic support) consists of two sub-abilities: (a) assess the credibility of sources of information; (b) to observe and assess reports the results of observation; (3) make inferences (inferring) consists of three sub-abilities: (a) make deductions and assess the deduction; (b) making induction and assess induction; (c) evaluating; (4) make a further explanation (advanced clarification) consisting of: (a) defines the term and consider the value of the decision; (5) set the strategies and tactics (strategies and tactics) consists of two sub-abilities: (a) formulate an action and (b) interacting with other people.

In LPTKs, to equip prospective teachers of biology who has facilitated professional competence through skills courses. One of the subjects of expertise in biology education courses are animal physiology. Physiology of animals is one of the compulsory subjects taken by students LPTKs biology education courses. In terms of the content of animal physiology to discuss the mechanism of action of many organ systems in the various animal groups, especially groups of vertebrates. With the characteristics of the material is quite complicated then in desperate need of learning critical thinking skills by students to solve a problem. Therefore, if observed from the characteristic aspects of the material being taught (content), the actual animal physiology lectures in LPTK occupies a strategic position in an effort to equip prospective teachers knowledge of biology professionals in particular to provide critical thinking skills. This step is necessary because, as noted Fisher (2007) that present critical thinking skills is widely seen as a demand basic competencies, as well as writing and reading, which should be taught and mastered by the learners.

On the other hand, as described by Liliasari (2001) that the science teachers at the forefront of education need to be equipped with a high-level thinking skills, so that students can develop patterns of thinking and able to solve various problems it faces in the field. To have these skills, then the prospective teacher candidates in particular science teacher / biological need to learn through lectures-lectures which he passes on LPTK. Therefore, in order that students can actively achieve these objectives, the faculty need to design learning activities that can develop the thinking skills of students.

Given the importance of teaching critical thinking skills in animal physiology for prospective biology teachers, need to be deliberate attempts to develop such capabilities through learning in LPTK animal physiology. Departing from the urgency of this research is then conducted a preliminary study to try to analyze the critical thinking skills of student teachers of biology in animal physiology lectures that they follow. Therefore, in this study can be formulated in a problem that is "What is the profile of

critical thinking skills of student teachers on the topic of biological respiratory system, circulatory system, and excretory system and *osmoregulation*? Urgency of this research was conducted as a line-based data for further research.

## 2. Methods

The method in this research is descriptive method. The choice of location and subjects undertaken purposively (Creswell, 2009). Subjects in this study were student teachers biology S1 Mathematics Department of Education and Science (PMIPA) FKIP Sriwijaya University who attended the lectures of animal physiology. The study involved 39 students of biology education class 2010/2011. To capture students' critical thinking skills profile done by having students fill out an instrument developed with reference to the critical thinking skills by Ennis (Costa, 1985) which focused on the indicators: 1) Focusing questions (BK1), 2) analyze the arguments (BK2), 3) Ask and answer questions (BK3), 4) consider the credibility of the source (BK4), 5) observe and consider the results of observations (BK5), 6) Creating an induction and consider the results of induction (BK6), and indicator 7) Making deduction and consider the results of deduction (BK7). Instruments used critical thinking skills first get weighed by the expert (expert judgment) and has conducted trials. In this study, analysis and data processing is done by descriptive statistics (Susetyo, 2010).

## 3. Data and Discussion

The data obtained in this study is the percentage of each indicator of critical thinking skills on each topic which student teachers achieved biology, where the indicators are captured in this study was limited to seven indicators of critical thinking skills, the results are shown in Table 1 overall.

**Table 1:** Recapitulation percentage of each indicator Critical Thinking on any topic that students achieved

| Indicators of critical thinking skills | TOPICS | | |
|---|---|---|---|
| | Respiratory system | Circulatory system | Excretion & Osmoregula-tion |
| BK1 | 34,64 | 46,15 | 35,8 |
| BK2 | 15,38 | 41,03 | 30,77 |
| BK3 | 20,51 | 28,82 | 25,64 |
| BK4 | 10,26 | 15,38 | 20,51 |
| BK5 | 28,21 | 35,89 | 33,33 |
| BK6 | 23,08 | 30,76 | 35,89 |
| BK7 | 12,82 | 28,82 | 28,21 |

Table 1 is an indicator of critical thinking of students achieved the highest that indicators to analyze the arguments on the topic of the circulatory system (46.15%), while the lowest is shown on the indicator to consider the credibility of a source on the topic of the respiratory system (10.26%).

For further details on the data processing and discussion obtained in this study can be explained by the following graphs.

**1. The Student Critical Thinking Skills on the Topic of the Respiratory System**

Percentage indicator reached critical thinking skills biology student teachers on the subject of the respiratory system are listed in Figure 1.

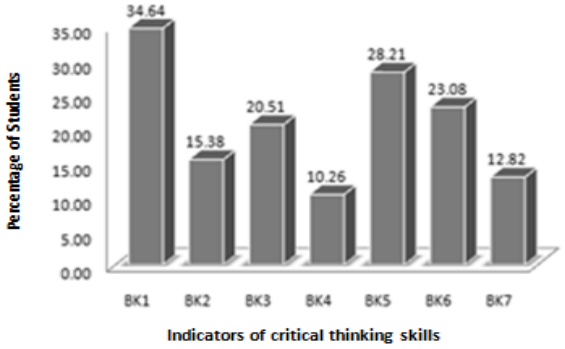


**Figure 1:** Percentage of critical thinking skills of student teachers of biology on the subject of the respiratory system

Based on Figure 1 can be explained that the level of students' understanding of the indicators of critical thinking skills in the subject of the respiratory system is still low. Looks percentage range (range) indicator of critical thinking of students achieved on the subject was 14.38, the lowest percentage in the indicator takes into account the credibility of a source (10.26) and the highest on questions focusing indicator (34.64). From the graph can be explained also that the average percentage indicator of critical thinking on the topic of the respiratory system is 19.41.

**2. Critical Thinking Skills Students on the topic of the Circulatory System**

On the subject of the circulatory system, student mastery of the indicators of critical thinking skills mastery percentage tends to show better. This can be seen by Figure 2 below.

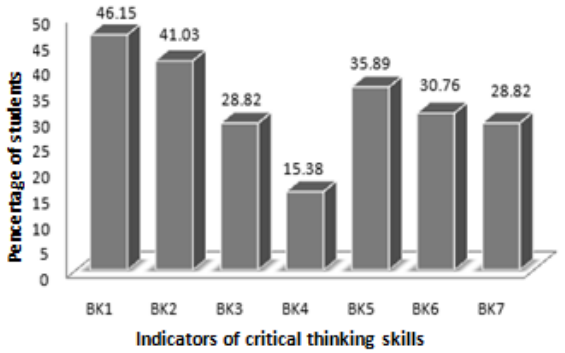


**Figure 2:** Percentage of critical thinking skills of student teachers biology on the subject of the circulatory system

Based on Figure 2 it appears that the range of percentages (range) indicator reached the critical thinking of students on the subject of the circulatory system is 30.77, the lowest percentage in the indicator takes into account the credibility of a source (15.38) and the highest on questions focusing indicator (46.15 ). From the graph can be

explained that the average percentage indicator of critical thinking on the topic of this circulation system is 32.41.

### 3. Critical Thinking Skills Students on the topic of excretion and *osmoregulation*

Mastery level biology student teachers to the indicators of critical thinking skills in the subject excretory system/*osmoregulation* is shown in Figure 3. From the graph shown in this study the percentage range (range) indicator of critical thinking of students achieved on the subject is 15.38, the lowest percentage in the indicator takes into account the credibility of a source (20.51) and the highest indicator focuses on the question and make the induction and consider the results of induction with the percentage of 35.89%, respectively. From the graph can be explained also that the average percentage indicator of critical thinking on the topic excretion system/*osmoregulation* is 30.03.

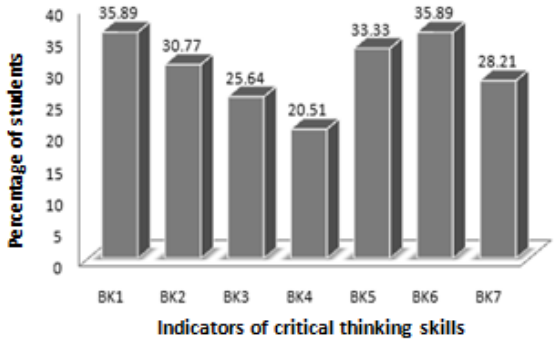


**Figure 3:** Percentage of critical thinking skills of student teachers in the principal language of biology excretion/*osmoregulation*

In the preliminary study, mastery of critical thinking skills biology student teachers in animal physiology lecture focused on the subject matter of three consecutive respiratory system, circulatory system, excretory system and/*osmoregulation* comprehensive manner can be said is still low. The fact is based on the average percentage of each indicator critical thinking skills achieved by students, where all indicators of critical thinking skills that are used in this study no one has yet reached half (50%). On average the low student achievement obtained in this study suspected nothing to do with the characteristics of animal physiology courses that are relatively difficult to understand. As explained Michael (2007) who reported the results of a survey on the factors that cause physiological difficult studied by students, identified four main categories: (1) the nature of the discipline of physiology itself that requires the ability to think or many reasoning concerning cause and effect relationship; (2) how to teach physiology that require packaging material pedagogically; (3) how students learn physiology, this is related to the readiness and ability of students to reason; (4) factors outside the classroom. But of these factors according to Michael (2007) believed the nature of the discipline and how students learn physiology is an important determinant of the physiology of why it felt difficult by students.

When examined factors reported Michael (2007) on the causes of difficult physiology studied by students, apparently in accordance with the results of the analysis in this preliminary study. It appears the second and third categories, namely how faculty teach and how students learn, it is closely related to the problem of learning methods that do lecturer in the classroom. From the results of interviews with some of the students about the learning process conducted animal physiology lecturer, was lacking direct the student-centered learning (student-centered, learning-oriented) and the behavior of lecturers teaching courses still "traditional" or "conventional" ie more focused on teaching, so the interaction that goes on in the classroom is more one-way, where learning activities more impressed as the "content of trans-mission". This condition causes less facilitated student learning needs or less given the opportunity to think and reason, thus causing absorption of the material provided students is relatively low. Yet according to the Higher Education (2008) at the college level, especially in LPTK where this institution has its own specificity, ideally ongoing learning should be fun, challenging, develop thinking skills, encourage students to explore, giving the opportunity for success, thus growing confidence, and give feedback immediately, so that the students know their success or failure. Thus, if all reasonable critical thinking skills biology student teachers in this study was low, as if referring to the findings of Michael (2007) that the study of animal physiology professors should strive to create lessons that require students to engage in activities that require students to think critically by activities to solve a problem is presented.

If observed on student achievement against indicators of critical thinking skills in all three subject matter seem to have in common is the low percentage of achievement in all indicators, especially in considering the credibility of a source indicator. It seems that the results of this study as a reference and in line with Fisher (2007) that in order to understand the problem by considering indicators of the credibility of a source, one must understand some knowledge of the criteria are quite complex, includes consideration of how the reliability reputation will source, whether that source had interests for themselves, what evidence corroborating independent sources, whether the source has relevance, how the properties associated with the claim, whether the source can provide the reasons that can be trusted, and so on. Therefore, it is quite natural that the students find it difficult to answer in the indicator instrument. In other words, the low students achievement on indicators at the same time consider the credibility of sources indicate that the student has not been able to consider the consequences of the information that they require to make an assessment as well consider in making a decision. On the other hand, in addition to requiring the criteria, the indicator is also in this study to consider the credibility of a source indicator explored through questions that require mastery of concepts that must be considered. Therefore, if a low student mastery of concepts it will affect students' critical thinking skills in the indicator. This is in accordance with the opinion of Dahar (1996) that the concepts are the building blocks (building block) thinking. The concepts are the basis for higher mental processes to

formulate principles and generalizations. So, there is a correlation between mastery concepts with critical thinking skills.

On the subject of the third indicator of critical thinking among most students seem to understand the question focus indicator. To explore this indicator, a matter of a discourse about the phenomenon, and students are asked to formulate questions in accordance with the phenomena that occur. In this case the skills needed for students to answer the question is an understanding of the discourse. Hence the reason that many students are able to formulate the question, so the performance indicators of critical thinking questions focus on average higher in this study.

## 4. Conclusions

In this study it can be concluded that the biology student teachers in a country LPTK South Sumatra shows mastery level critical thinking skills are still low on the subject of the respiratory system, circulatory system, excretory system and / *osmoregulation*. This is based on the percentage of student achievement against all indicators of critical thinking skills that do not exceed 50%. At each indicator reached critical thinking of the third subject of the lowest level of the subject matter to achieve them is shown in the respiratory system.

## 5. Recommendations

Based on the results of this research, given the importance of the mastery of critical thinking skills for student teachers of biology, it is relevant to do further research to find new ways of relating to the lecture more innovative strategy and direct participatory student-centered learning (student-centered, learning-oriented) to improve and develop the critical thinking skills of student teachers.

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