



## Biology Student Teacher's Critical Thinking: An Exploration Study

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**Abstract:** Critical thinking is incorporated in learning outcomes to enable student teacher to analyze, evaluate, and synthesize information in the new era of information and technology era. It is very important for the preparation and understanding of their future profession as a teacher who was crucial in setting up the community of critical thinkers. This study aimed to determine the critical thinking ability of Biology student teachers. The method used is descriptive analysis with the total research subject is 98 sophomores in Biology Education at State University of Malang. The instrument used is critical thinking test consisting of 25 multiple choice questions which refer to Watson-Glaser Critical Thinking Appraisal (WGCTA). Data were analyzed using *SPSS 22.0 for Windows* with descriptive statistic. The result showed that only 35 students (35.71%) who have achieved critical thinking ability with the average of 61.39. Ability to evaluate the argument has the highest average ( $X=79.39$ ) and make inference has the lowest average ( $X=27.14$ ). Efforts to overcome the lack of critical thinking ability can be done by training the students to solve problems from multiple resources, one of them is through a challenge based learning.

**Keywords:** critical thinking, student teacher, WGCTA

Critical thinking skills are very important for the university students (Abdi, 2012). With the critical thinking skills, students can find the right information by analyzing, evaluating (Watson and Glaser, 2012; Wallace and Jefferson, 2013) and read various information from the internet reflectively (O'Hata, 2014), which validity still unclear because it is not evaluated as well as in print media (Ranaweera, 2008), in preparing a variety of tasks including research study. Wallace and Jefferson (2013) explained that the ability to think critically is very important for the research process, including narrowing the topic of research, developing the research questions, and determining whether the information is relevant or not to the research conducted. Critical thinking skills can also make the students not just memorize the facts in learning (Gun et al., 2008), but also can construct knowledge through the evaluating, analyzing (Cekin, 2015), interpreting, and deducing information (Qamar, 2016). In other words, critical thinking can help the university students to emphasize the higher level of thinking abilities in teaching and learning (Smith and Szymanski, 2013).

The importance of critical thinking skills is no longer being a controversy especially in the education field. Yet, the definition of critical thinking skills is still being a subject of debate by the experts. In this study, the definition refers to the ability to think some of the following definitions. Critical thinking is defined as the ability to analyze evidence, make a conclusion by deduction or induction, evaluate, and make decisions or solve problems (Lai, 2011). Critical thinking is also defined as the ability to identify and analyze problems and search and evaluate relevant information to reach a proper conclusion (Watson and Glaser, 2012). Critical thinking in a simple way is defined as analyzing and evaluating information (Duron et al., 2006). Based on some of these definitions, the most important part of critical thinking is to analyze and evaluate information and use it to find the right decision.

Critical thinking skills and the abilities which relevant to the critical thinking is also very important for the student teachers related with the preparation and the understanding of their profession as a teacher in the future (Bahr, 2010; Allammakhrah, 2012). The ability to evaluate and analyze information is crucial for the teachers' professional competence. With these abilities, student teachers will be able to convey the material correctly and accurately in accordance with the science development. In terms of pedagogical, student teachers will also be able to perform the teaching and learning process that encourages students to have the ability to think critically (Akkaya, 2012; Akgun and Duruk, 2016). For the student biology teacher it is very important, remembering the perception of the majority students which consider that biology is a matter of abstract material and full of recitation which affected the learning strategy used by students who put more emphasis on the ability to memorize (Monsour, 2011; Cimer, 2014, Carlan et.al., 2014, Lin et. al., 2014), which belong to the low-level thinking skills (Anderson and Krathwohl, 2001). With critical thinking skills, student teachers will also familiar with the self-reflection (Elder and Paul, 1994; Weissinger, 2004). With the strong ability of self-reflection, a prospective teacher will be able to improve the quality of learning which is done continuously. Thus, the prospective teachers with the critical thinking skills are qualified teacher candidates and required to improve the quality of education and to educate the students to become qualified people (Gedik, 2013; Kezer and Turker, 2012). One of the efforts to provide teachers who are critical thinkers is by providing prospective teachers education with the curriculum and the teaching and learning process that consider the critical thinking skills as the specific goal (Gunn et al., 2008; Akkaya, 2012; Akgun and Duruk, 2016).

One of the prospective teachers education that considers critical thinking in the curriculum that is written in the graduates' achievements are Biology Education Study Program, State University of Malang. In achieving the required outcomes of graduates needs an appropriate learning strategy. However, the lecturer as the instructional planner must know first the prior knowledge of their student teachers. Some researchs showed that the student teachers' critical thinking skills is low (Akgun and Duruk, 2016; Suciati, 2015; Rusdi and Umar, 2015; Bakir, 2015; Wibowo et al., 2012). Meanwhile, the result form Gojkov et al. (2015) showed that although the student teachers' estimation about their critical thinking skills are very high, but still has not been actualized in a situation that requires the application of some aspects of measurement indicators. Until now there has been no reports of Biology student teachers' critical thinking skills. The objective of this research is to determine the critical thinking skills level of the first semester Biology student teachers at the State University of Malang.

## METHOD

This study was used a descriptive approach. This study was conducted on 98 freshman biology student teachers in Biology Education Study Program, State University of Malang batch 2016. The research instrument used was a critical thinking test which developed with reference to the Watson Glaser Critical Thinking Apraissal (WGCTA) indicators (Watson and Glaser 2008 ; 2012). The critical thinking test was in the form of objective test consisting of 25 items. The test consisted of three main abilities. The first ability is making the conclusion, it consists of 15 items. The second ability is recognizing assumptions, it consists of 5 items. The last ability is evaluating the argument, it consists of 5 items. The ability to make conclusions consists of 3 sub abilities namely inference, deduction, and interpretations with 5 items in each sub. The time given for doing this test is about 30 minutes. The statistical test showed that the developed test is valid and reliable with a Cronbach Alpha reliability coefficient of 0.57. The data collected in this study were analyzed using SPSS. 22.0 for windows to determine the average and the standard deviation of each capability. Students who gain a greater score than

the average plus standard deviation are classified as high ability, students who gain a lower score than the average minus standard deviation are classified as low ability, while the students who gain a score between the two categories were classified as medium abilities. Thus, we will get an overview categories of low, medium, and high on each aspect of critical thinking skills of freshman biology student teachers.

## FINDINGS AND DISCUSSION

Based on the research conducted, it was obtained the highest average of 79.39 on the ability to evaluate the arguments, the average ability of deduction was 69.59, the average ability of the assumption was 65.71, the average ability of interpretation was 65.10, and the lowest average was 37.14 on the ability to make inference. The overall average of students' critical thinking skills was 61.39. This result showed that relatively the students' critical thinking skills is still in the medium level. The average and standard deviation of each students' critical thinking skills can be seen in Table 1.

Table 1. Average and standard deviation of each critical thinking skills

No	Skills	Average	Standard Deviation
1	Inference	27.14	23.02
2	Assumption	65.71	20.31
3	Deduction	69.59	15.79
4	Interpretation	65.10	25.25
5	Argument Evaluation	79.39	18.71
Total		61.39	10.88

The critical thinking skills of freshman biology student teachers in each critical thinking skills are defined as follows.

### 1. The ability to make inference

Students' ability to assess the probability of a conclusion based on the accuracy of the information provided in a statement. Students should be able to recognize the presumption accuracy level ranging from wrong, may be wrong, there is no, probably true, and true in accordance with the given statement. Based on the descriptive analysis result of the ability to make inferences found that students who have the high ability were 19 people (19%), students who have the medium ability were 51 people (52%), and students who have low ability were 28 people (29%). The result is presented in Figure 1.

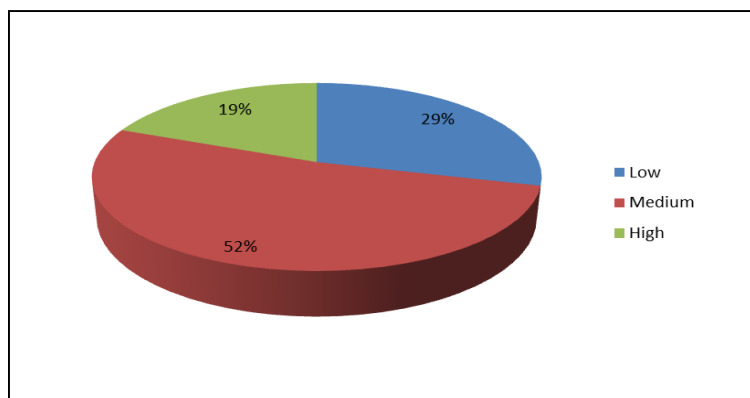


Figure 1. the percentage of the ability to make inference

## 2. The ability to recognize assumption

The ability to identify the assumption provided in a statement. Students must be able to distinguish the assumption that justifies the statement and the assumption that do not justify the statement that has been provided. Based on the descriptive analysis results of the ability to recognize assumption found that students who have the high ability were 7 people (7%), students who have the medium ability were 68 people (69%), and those who have low ability were 23 people (24%). The result is presented in Figure 2.

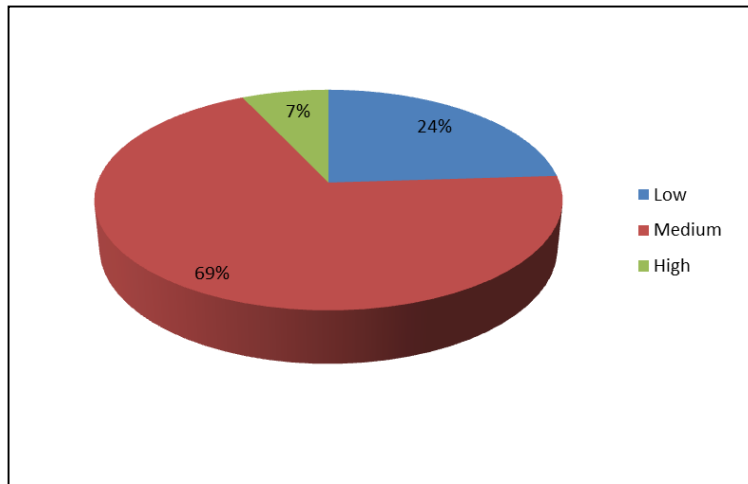


Figure 2. The percentage of the ability to recognize assumption

## 3. The deduction ability

The ability to determine a logical conclusion and follow the information that is provided or not provided. Based on the descriptive analysis result of the deduction ability found that students who have high ability were 9 people (9%), students who have medium ability were 80 people (82%), and those who have low ability were 9 people (9%). The result is presented in Figure 3.

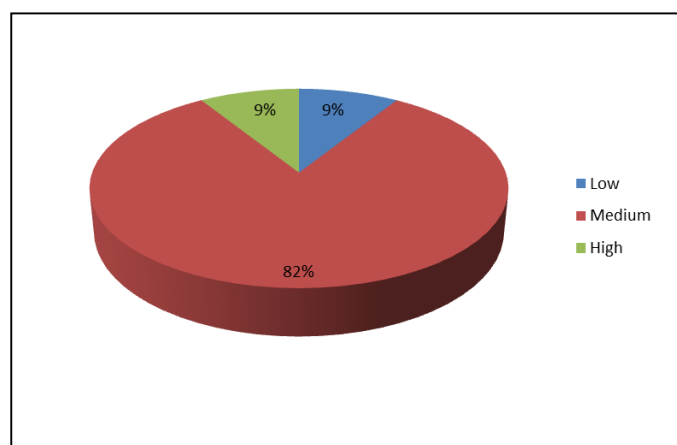


Figure 3. The percentage of the deduction ability

## 4. The interpretation ability

Ability to assess the fact and evidence and determine whether the conclusions was made based on the data that has been provided or not. Based on the descriptive analysis result of the

interpretation ability found that students who have high ability were 17 people (17%), students who have medium ability were 73 people (75%), and those who have low ability were 8 people (8%). The result is presented in Figure 4.

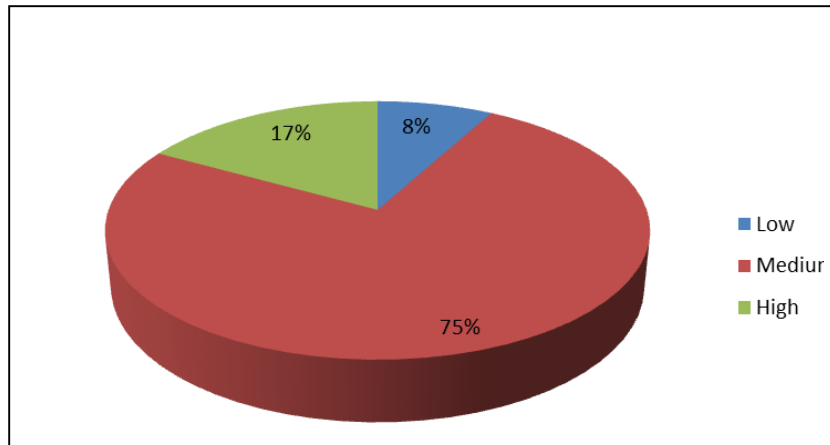


Figure 4. The percentage of the interpretation ability

#### 5. The ability to evaluate argument

The ability to assess an argument in its strength and its relevance to a problem. Students should be able to assess whether the argument given is strong or weak. Based on the descriptive analysis result of the ability to evaluate the arguments found that students who have high ability were 34 people (35%), students who have the medium ability were 57 people (58%), and those who have low ability were 7 people (7%). The result is presented in Figure 5.

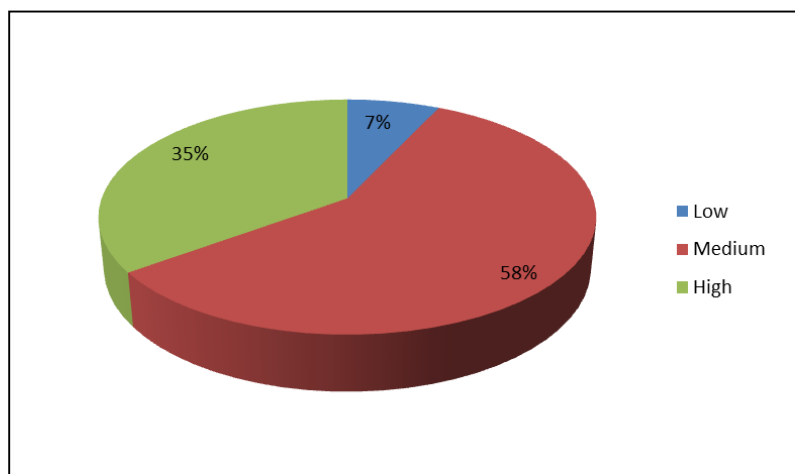


Figure 5. The percentage of the ability to evaluate argument

From the descriptive analysis result on all critical thinking skills found that students who have high ability were 14 people (14%), students who have medium ability were 68 people (70%), and students who have low ability were 16 people (16%). It is presented in Figure 6. The descriptive analysis result also showed that only 35 students who can achieve the critical thinking (the minimum score was 65).

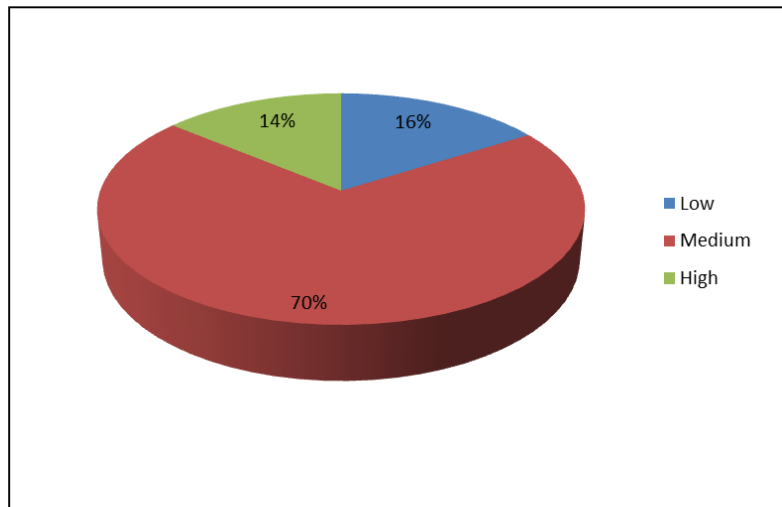


Figure 6. The overall percentage of critical thinking skills

The profile of all measured aspects showed that the students' ability to determine a statement of "right and wrong" or "yes and no" with the provided information have reached the criteria fairly well, but when the choice of determining a statement is ranged into "Right" "Almost Right", "No Data", "Maybe Wrong" and "Wrong" as in the inference ability, the students were still find difficulties in determining the level. The descriptive analysis result of each students' critical thinking skills showed that the ability with the highest average and belong to the high category is the ability to evaluate the arguments, and the ability with the lowest average and belong to the low category is the ability to make the inference. In general, the students' critical thinking ability from each aspect measured was fairly equal and classified as the intermediate level. This result is in contrast with some previous researchs which showed that the level of student teachers' critical thinking skills is on the low level. A number of studies showed that the student teachers' critical thinking skills is low (Akgun and Duruk, 2016; Suciati, 2015; Rusdi and Umar, 2015 ; Bakir, 2015; Wibowo et al., 2012).

This study has showed the Biology student teachers' level of critical thinking skills. However, this research is still have some shortcomings that must be reviewed remembering the limitations of the subject which only includes one level (freshman) and the number of questions in the test used as instrument is only 5 items per indicator. Thus, it is recommended for further researchs to show the Biology student teachers' level of thinking at all levels and includes several universities as well as adding the number of questions for each indicator.

The intermediate level of Biology student teachers' critical thinking skills showed that it is needed a learning environment that supports students to enhance their critical thinking skills with the suitable methods and strategies. Watson and Glaser (2010) explained that in order to improve critical thinking skills at the intermediate level is by encouraging students to gather enough information so it can indirectly analyze the arguments objectively and make conclusions based on the interpretation of the right evidence. One of the learning strategy which emphasize on the information is Challenge Based Learning especially on the question guide step, activity guide, and resource guide (Apple Education, 2008; 2011). The results of some previous studies and this study also showed that there is a need for basic standards as a minimum critical thinking skills that must be achieved by the Biology student teachers to become a qualified Biology teacher.

## CONCLUSION

The Biology student teachers ability is in the intermediate level with the average of 61.39. The lowest ability is in the ability to make conclusion (sub ability to make inference) with the average of 27.14 and a highest ability is on the ability to evaluate argument with the average of 79.39.

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