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An Analysis of Grade XI Students' Critical Thinking Skills on Animal Tissue Topic in SMA Negeri 1 Kota Mungkid

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Abstract

These days, critical thinking skills is one of competency that should be developed in students. Critical thinking skills is the ability of a person spotting condition or phenomenon and able to provide judgment according to their prior knowledge. School as an educational organizer has an important role in nurturing and evaluating students critical thinking skills through teaching-learning activity. In 2013 Curriculum, we can find that this aspect is emphasized in every learning process but in fact there are schools do not apply teaching-learning activity that can develop critical thinking skills. This study capturing how the critical thinking skills of SMA Negeri 1 Kota Mungkid 11th grade students in animal tissue topic. This study is a qualitative study with analysis method. Data of this study was taken using observation, interview, test, and questionnaire. The result shows that 53,62% of students belong to low critical thinking skills category due to lacking of variety learning method in the teaching-learning activity (using conventional method instead of variety of models). Also, the questions given to the students didn't support critical thinking skills approach. Because of the Final Exam for this semester so the research's time is quite short.

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INTRODUCTION

Rapid development of science and technology in 21st century has led to a demand skills. These skills are known as 21st century skills, which contain a variety of skills needed in 21st century. There are many views related to 21st century skills. As reported by *Global Cities Education Network Report 2013* there are three crucial competencies needs to hone to face global workforce. These skills are: Cognitive Skills (academic skills, critical thinking skills, and creativity), Interpersonal Skills (communication and collaboration, leadership, and global awareness), and Intrapersonal skills (developing thinking and motivation) (Soland *et al.*, 2013). At the same time, 21st century skills include several things including critical thinking skills, having a creative attitude, being able to work together, metacognition competencies, and having motivation (Lai, 2011). Aside from those views, skills needed in 21st century are known as the Four Cs - critical thinking, creativity, communication, and collaboration (P21, 2019). Summarily, these skills are the skills that every individual should have to overcome problems and achieve success in education and workforce today (Ball *et al.*, 2016).

The ability to think critically is one of the skills students must possess. Due to the rapid development of science and technology, students must be prepared to face global workforce. As stated by Seferoglu & Akbiyik (2006), Critical thinking skills is an ability of a person spotting condition or phenomenon and able to provide judgment based on one's knowledge and thoughts. This thinking skills has several characteristics including the ability to analyse, communicate effectively, enjoy do research and inquiry, flexible and tolerant of ambiguity, open-minded, solve problems creatively, have high curiosity, and learn collaboratively (Boss, 2014).

As stated in The Education 2030 Framework for Action, UNESCO mentioned that critical thinking skills is still one of the achievements in the field of education (UNDP, 2015). Critical thinking skills is one of the most important goals in all sectors of education (Phillips & Bond, 2004). This skill is an important element in education. Shaping humans into independent individuals, able to think effectively, and teach how we think is the goal of education (Mohammad *et al.*, 2015). Hashemi (2011) emphasize the adoption of critical thinking skills into the classroom can prepare students to face life both at the next level of education and compete globally. Moreover, critical thinking is also very useful in various contexts of life such as helping us to shun mistakes in making decisions, being more careful of what we do, and incredulous in existing issues. Teaching critical thinking skills is necessary for students because it is a very important skills in life. Hence, it is hoped that teaching-learning activity in school is capable in preparing students to become individuals who have 21st century competencies, especially critical thinking skills.

Essentially, the current *Kurikulum 2013* has put critical thinking skills in teaching-learning activity. This statement can be seen in 2016 Minister of Education and Culture Regulation No. 20 regarding *Standar Kompetensi Lulusan* which said that critical thinking skills are goals that must be achieved in the teaching-learning process. Further, 2016 Minister of Education and Culture Regulation No. 21 also emphasized that the current *Standar Kompetensi Lulusan* have been customized with 21st century skills.

Peraturan Menteri Pendidikan dan Kebudayaan also highlight the students' competencies for biology subject, which are able to understand the scope of biology and its application in the 21st century, linking biology to the environment, technology, and 21st century society, and able to analyze various biological events take place in nature and living things. One of the integrations of critical thinking skills in the *kurikulum 2013* can be seen in *Kompetensi Dasar* (core competencies) of animal tissue topic. KD 3.4 showed the core competencies for animal tissue topic is analysing the relation between cell structure in animal tissue and functions in animal organs. Bloom Taxonomy point out that analysis included in critical thinking aspect.

Implementation of *Kurikulum 2013* is expected efficient in boosting students' critical thinking skills in Indonesia. However, according to the result of PISA (Program for International Student Assessment) in 2018, Indonesia facing a degeneration for science. In 2015 Indonesia gained 403 points, but in 2018 diminishes to 396 (OECD, 2018). Even though, PISA result is for Junior High School students but it can be

reflecting our education system from middle to the upper school. Due to the fact, we can say that critical thinking skills students in Indonesia are still relatively low and need to develop a better strategy in education. Animal tissue topic is a biology topic given in first semester of 11th grade students. This topic study the structure and function in animal tissue. *Permendikbud nomor 24 tahun 2016* shows the *kompetensi dasar (KD)* that desire to achieve for this topic are (3.4) analysing the relation between cell structure in animal tissue and the functions in animal organs, and (4.4) presenting data of observation in tissues structure and organs of animal. This topic is considered as abstruse topic because it is microscopic so we lack of actual material.

Researchers that have been studying critical thinking skills in Magelang are Muskitta and Djukri (2016), expounding the impact of Problem Based Learning model on students' critical thinking skills and creativity in SMA Negeri 2 Kota Magelang. Another researcher, Kulsum (2014) describe the enhancement of students' critical thinking skills by developing worksheet in SMA Negeri 2 Kota Magelang. The two previous studies were classroom action research (PTK) to look at the effect of the media or models on the critical thinking skills of senior high school students in Magelang. However, currently no research has been found on the analysis of students' critical thinking skills without giving any treatment to public senior high school students in Magelang. There are 10 public senior high school in Magelang that implementing *Kurikulum 2013* including SMA Negeri 1 Kota Mungkid. In 2019, SMA Negeri 1 Kota Mungkid is one of three schools that got high score in biology national examination. Based on those things, the researcher decided to do final research in SMA Negeri 1 Kota Mungkid.

Analysis of students' critical thinking skills is needed to measure the impact of teaching-learning activity on critical thinking skills of students. Seeing that critical thinking skills is essential for students as well as the analysis of this skills, also no research has been found that describe specifically on analysis critical thinking skills in animal tissue topic of public senior high school in Magelang so that the researcher need to conduct a study on " An Analysis of Grade XI Students' Critical Thinking Skills on Animal Tissue Topic in SMA Negeri 1 Kota Mungkid ".

RESEARCH METHOD

The data of this study is information obtained through observation, interviews, and documentation which is then described thoroughly based on the prerequisite of case studies of students' critical thinking skills at Mungkid 1 Public Senior High School. The school was chosen using a purposive sampling technique assumed from the results of the 2019 National Exam for biology subjects in Magelang. Samples for each school was taken by using purposive sampling technique. This study undertaking passive participation observation in which the researcher is present to observe the activities without involved directly or intervened in those activities (Sugiyono, 2013). The entire collected data then assembled into a descriptive study of the analysis of critical thinking skills of 11th grade students using triangulation methods. Samples were taken using purposive sampling where the researcher chose 2 classes which the most relevant with this study. A well-thought-out interview with teachers are well conducted where the researcher has prepared a list of questions while students are given a questionnaire (self-assessment) of critical thinking skills. Aside questionnaire, students are asked to fill in the questions paper that have been made by researchers.

Two classes that have been chosen is based on Arikunto (2010), he said that if the subject is more than 100 participants, so we can take 10-15% of the participants. In SMA Negeri 1 Kota Mungkid there are five science classes and every class is about 34 students. Those two classes are Science 1 and Science 5 Grade 11th, it is because their class is taught by the same teacher and to see is there any significant differences from those classes.

On this research, the researcher refers to Ennis (2011) about critical thinking's indicators. They are (1) give a brief explanation; (2) decision making; (3) concluding; (4) provide further explanation; and (5) strategy and tactics. So that, the questionnaire and test instruments that given on this research also customized with Ennis's view. Besides, the test instrument also integrated to Taxonomy Bloom. The activity observation sheet include two aspects which is learning-teaching components and critical thinking

components. The teaching-learning components are teaching model and method, the media that used in leaning-teaching activity, and lesson plan (RPP) suitability. For the critical thinking components they are kinds of questions that given to students, students activity, students ability to explain back and answering question, and making a hypothesis.

Secondary data was obtained by reviewing syllabus, lesson plans, and past exam papers for animal tissue topic. Researchers also collected other data by taking pictures and recording audio that can be used in supporting data of this study. The following table is the research instruments used during this study:

Table 1 Types, Data Sources, and Research Instruments

| No | Types | Data Sources | Method | Instrument |
|----|------------------------------|--------------|--|---|
| 1 | Critical Thinking Skills | Students | <ul style="list-style-type: none"> • Observation • Test • Questionnaire | <ul style="list-style-type: none"> • Students Observation Notes • Test Paper • Questionnaire Paper |
| | | Teacher | <ul style="list-style-type: none"> • Structured interview | <ul style="list-style-type: none"> • Interview Notes |
| 2 | Teaching-learning Activities | Teacher | <ul style="list-style-type: none"> • Observation • Structured interview | <ul style="list-style-type: none"> • Observation Notes • Interview Notes |
| | | Students | <ul style="list-style-type: none"> • Observation | <ul style="list-style-type: none"> • Observation Notes |

Data processing in this study was carried out refers to Miles and Huberman models. In this model, the sequence of data processing begins with data reduction, data display, and ended with conclusion drawing/verification. Data reduction means abridging or selecting the main points. For the first step, the researcher focused the data on the objectives. The next step is data display, where the selected data is presented descriptively or using table. The final step is conclusion drawing or verification. This conclusion depends on the collected data, so it might change or stay the same. (Miles & Huberman, 2007).

The researcher carried out scoring of each possible answer for test paper assessment using an unified rubric of scoring critical thinking skills with essay tests developed and modified by Zubaidah (2015) as shown in the following table.

Table 2 Rubric for Students Critical Thinking Skills Test

| Score | Description |
|-------|--|
| 5 | - Accurately answer all questions with relevant concept. Distinctly answered and supported by strong reasons |
| | - Excellent flow of thoughts |
| | - Good and correct grammar |
| 4 | - Accurately answer most of the questions with relevant concept. Distinctly answered but the given reason doesn't reassured enough |
| | - Excellent flow of thoughts, some concepts are linked |
| | - Good and correct grammar |
| 3 | - Accurately answer few questions with relevant concept but fails answer distinctly |
| | - Good flow of thoughts, few concepts are linked |
| | - Good grammar, misspell few words |
| 2 | - Fails to answer accurately, distinctly and irrelevant |
| | - Poor flow of thoughts, concepts are detached |
| | - Good grammar, misspell few words |
| 1 | - Fails to answer with relevant concept |

| | |
|---|------------------------------|
| | - Poor flow of thoughts |
| | - Poor grammar |
| 0 | - Fails to answer accurately |
| | - Poor grammar |

The students' critical thinking questionnaire was made using a Likert scale. Questionnaire consists of 4 alternative answers, namely Strongly Disagree is worth 1 point, Disagree is worth 2 points, Agree is worth 3 points, and Strongly Agree is 4 points. Questionnaire scores and tests obtained by students on each statement or question will be totalled and set to be a final grade. The researcher matched the percentage of final grade up with a table of critical thinking categories referring to Setyowati (2011). Following is the formula for converting scores obtained by students into a final grade.

$$FG = S/MS \times 100$$

N.B.:

FG : Final Grade

S : Obtained score

MS : Maximum Score

Table 3 Critical Thinking Skills Categories for Students

| Range | Category |
|---------------|---------------|
| 81,25 – 100 | Very critical |
| 62,50 – 81,25 | Critical |
| 43,75 – 62,50 | Low critical |
| 25,00 – 43,75 | Uncritical |

RESULT AND DISCUSSION

Researcher selected 11th grade of science 1 and science 5 in Mungkid 1 Public Senior High School as sample of this study. According to the analysis of the results of observations of the learning process and teacher interviews, the characteristics of teaching-learning process in Mungkid 1 Public Senior High School can be seen in table 4 as follows:

Table 4 Characteristics of Teaching-Learning Process in Mungkid 1 Public Senior High School

| Criterion | Observed aspects |
|------------------------|--|
| Components of Learning | The teacher always delivers the learning objectives before the main activity starts Student-centered learning models are rarely used The teacher utilizes PPT and macromedia flash media in the teaching-learning process The teacher uses a handbook “Biologi Kelas XI” as a reference in teaching The teacher replaces the pre-test and post-test by reviewing the previous topic The teacher gives homework to students In teaching-learning process, the teacher uses impromptu methods most of the time About 60% of teaching-learning process, students spend more time working on questions and taking notes than discussions with peers The teacher reviews the topic after the learning activities finished |

Based on the results of the biology teacher interview, biology learning in 11th grade of Mungkid 1 Public Senior High School mostly uses a diverse lecture methods in the delivery of topics. Using conventional teaching methods only focused on the students, but according to Djamarah in Sprott and Gafur states that by providing variations in it can boost student enthusiasm for learning. this method known as diverse lecture methods because there are several components, such as lecture method (question and answer, discussion,

and assignment), media variation (student senses are involved as much as possible in the learning process), variations in appearance (motion, expression, sound, interlude and contact point of view), as well as variations in presentation stuff.

Viewing the results of interviews and observations, the teacher conducts questions and answers session with students during teaching-learning process by giving questions so that the students stay focused on teaching-learning process. Moreover, the implementation of laboratory activities is also a variation of learning provided by teachers such as in animal tissue and digestive system topic. Lab-based learning provides an enjoyable learning because students are directly involved and nurtured to think. Hence laboratory activities allow students to get more cognitive load compared to conventional learning.

The teacher distributed the Student Worksheet (LKPD) a few days before the laboratory activity as a guide for students. It is aims to prevent misinterpret and make a better understanding for students so that they can conduct the activity accurately. LKPD is prepared independently by the teachers. This preparation aims to make a suitable LKPD for their own students. According to Arafah *et al.* (2012), LKPD helped teaching-learning activities better and build an effective interaction between teacher and students so that an enjoyable and effective teaching-learning activity accomplished.

The teacher conducting an end-chapter test for each topic, mini quiz, and giving homework for cognitive assessment. According to the conducted observation, CBT-based end-chapter test was conducted. According to the teacher, CBT-based end-chapter test mostly conducted except there is a technical error. CBT-based test allows students knowing their score directly. CBT-based end-chapter test usually utilize multiple choice type questions.

Teacher also conducting unnoticed mini quiz for cognitive assessment. This method aims to find out is the previous topic left a deep impression to students or not. The quiz is done orally and usually held before the main activity start. Based on Sanchez's research (2017) giving quizzes to students can boost student performance. Another advantage is that students must study the topic thoroughly, which can encourage students to good study habits (Balter *et al.*, 2013). Roediger *et al.* (2011) reveal the indirect benefits of quizzes which is self-assessment for students when relating the topic to a precise argument. However, developing students' critical thinking skills through quiz activities need to insert high-order thinking skills questions which integrated with critical thinking indicators.

According to the results of teacher interviews, laboratory activities are also used as a student evaluation tool. There are three aspects assessed in laboratory activities, such as cognitive aspects, affective aspects, and psychomotor aspects. A further significance of laboratory activities is the involvement of students in learning activity which leads to a better understanding of the topic being practiced. Involvement in learning implies process skills that give students the opportunity to find solutions to questions. Using laboratory activity as a tool for evaluation make easier for teachers to assess whether students have understood the topic that has been given in class.

Researchers conducted an analysis of the questionnaire, test results, and observations during the research activities to see students' critical thinking skills. The data in table 5 is the average questionnaire results obtained by each class, table 6 contains the average test results for each class, and table 7 is the data analysis of student observations in class.

Table 5 Average Questionnaire Results

| Sample | Number of Students | Total Questionnaire Score | Average | Category |
|--------------|--------------------|---------------------------|---------|----------|
| XI Science 1 | 36 | 2674,8 | 74,3 | Critical |
| XI Science 5 | 33 | 2356,2 | 71,4 | Critical |

Table 6 Average Critical Thinking Skills Test Results

| Sample | Number of Students | Total Score | Average | Category |
|--------------|--------------------|-------------|---------|--------------|
| XI Science 1 | 36 | 2223 | 62 | Low critical |
| XI Science 5 | 33 | 1997 | 61 | Low critical |

Table 7 Observation of Students' Critical Thinking Skills

| Criterion | Observed Aspects |
|--|---|
| Components of Students' Critical Thinking Skills | <p>Students are able to provide a simple explanation of the material learned in several learning activities.</p> <p>Students are incapable to provide further explanation of the topic being studied.</p> <p>Some students are able to give examples of the application of topics learned in daily life.</p> <p>Only a few students are able to deduce the topic of learning.</p> <p>Students are less enthusiastic when given the opportunity to share their opinions.</p> <p>Students are lack of enthusiasm in asking questions, only a few students are actively asking.</p> <p>Students seem to be able to give questions according to the learning topic being studied.</p> <p>Some students seemed able to answer questions from the teacher.</p> <p>The ability of students to provide hypotheses for a problem is still invisible.</p> |

There are differences in the results of questionnaire with the test because the questionnaire can't explain the statement clearly, so it lead to misperception on students, mostly questionnaire are given after the treatment so the participant might don't remember what was asked or stated, also the participant might not be willing to give answers honestly because he/she think that giving honest answers can left a negative impact at him/her (Milne, 1999).

Results of analyzing the critical thinking skills test showed that 53,62% students of 11 science 1 and science 5 in Mungkid 1 Public Senior High School is low, this result supported by conducted learning activities observation. Meanwhile, figure 1 and 2 shows the score acquisition for each student's answer to each question.

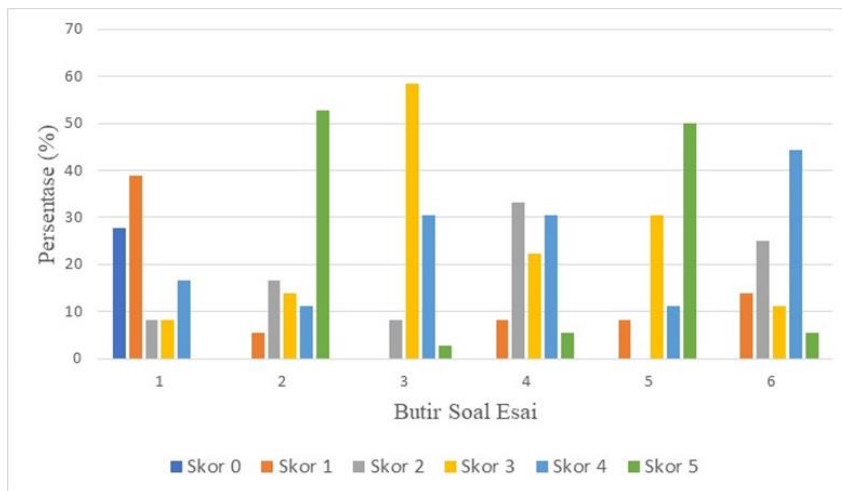


Figure 1 Graphic of percentage of students answer score on each question in 11 science 1

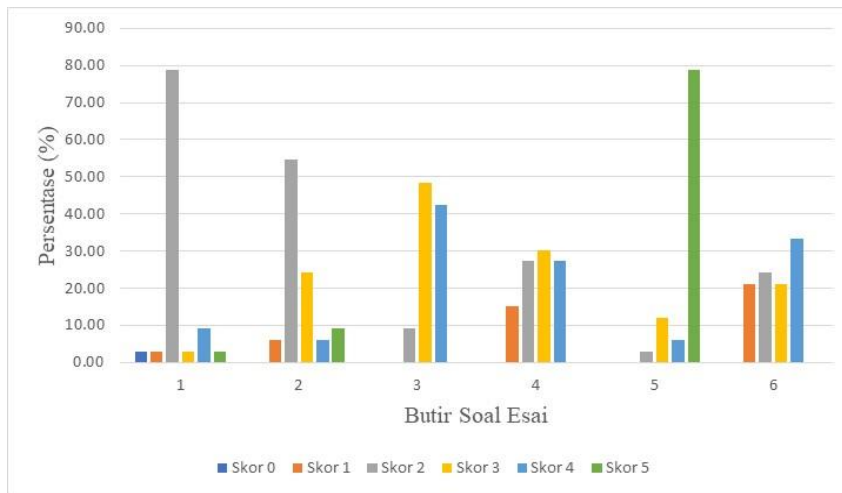


Figure 2 Graphic of percentage of students answer score on each question in 11 science 5

The researcher giving open-ended questions that has been modified with critical thinking skills standard referring to Ennis (2011), namely (1) give a brief explanation; (2) decision making; (3) concluding; (4) provide further explanation; and (5) strategy and tactics. Development of students critical thinking skills influenced by internal and external factor. Internal factor is factor that comes from themselves such as motivation and curiosity. Meanwhile external factor is factor that comes from their surroundings, such as learning model applied by teacher and school infrastructure that support the development of critical thinking skills. These two factors are connected and influence each other. Critical thinking skills of students won't develop to the maximum if one of these factors does not support it.

Initial observation activities carried out by Hermayani *et al.* (2015) in Surakarta 1 Batik Senior High School regarding learning motivation and critical thinking skills in learning biology shows that most students still have low learning motivation. Learning motivation is a driving force in students to study, which ensures the continuity of learning activities so that the objectives of learning activities are achieved (Sardiman, 2011). Loes (2015) stated that learning motivation has a strong relationship with critical skills. Students who have high learning motivation and hard work will also have a good influence on their critical thinking skills.

External factors also influence the development of students' critical thinking skills. Some external factors that can affect critical thinking skills include learning models applied, teacher competencies regarding critical thinking skills, and school infrastructure. Based on observations and results of teacher interviews, it was found that biology learning in 11th grade of science in Mungkid 1 Public Senior High School still implement conventional models or lectures model even though in teaching-learning activities the teacher provides variations. The implementation of this learning model results in the low students' critical thinking skills. According to Gunawan (2007), students who are only taught by lecture learning model get lower learning outcomes than students with the lecture-giving assignment or practical-lecture model.

There are several learning models are proven in improving students' critical thinking skills, including discovery learning and inquiry learning. 2016 Minister of Education Regulation number 22 stated that the need for implementation of discovery-inquiry based learning to strengthen the scientific approach, integrated thematic, and basic thematic.

Another learning model that can develop students' critical thinking skills is problem-based learning. Research conducted by Boleng *et al.* (2017), concluded that problem-based learning has a positive influence on the development of students' critical thinking skills which cannot be done using conventional learning. This is correlated with Wulandari's *et al.* (2011) research on the effect of using problem-based learning on learning activities. She stated there was a significant difference from the critical thinking abilities of students who were taught using the problem-based learning model with those using conventional learning models. The results show students with learning using problem-based learning have higher critical thinking skills

compared to students who are taught with conventional models.

Getting critical thinking skills-based teaching is a necessity for students because critical thinking is a very important ability in life. Critical thinking skills can be trained and empowered in various ways such as using appropriate learning models, appropriate and adequate teaching materials, assignments, and using literature that is able to develop these skills (Lai, 2011; Suryani *et al.*, 2016).

Active learning makes teaching and learning more enjoyable, both for students and teachers. And most importantly, it can encourage students to think critically. The importance of measuring critical thinking skills is justified by Travis's opinion (2015) that critical thinking is an essential ability that can be used as an indicator of learning success in achieving competency standards.

CONCLUSION

Students' critical thinking skills of 11th grade of science 1 and 5 in Mungkid 1 Public Senior High School included in the low critical category. There are various factors that influence the development of critical thinking skills such as the learning methods used, learning motivation, curiosity, and the characteristics of the questions given. Based on the conducted interview and observation, it can be seen that the learning methods and the characteristics of given questions in biology class in Mungkid 1 Public Senior High School have not been able to support the development of students' critical thinking skills, especially students of 11th grade of science so that it affects the low motivation and curiosity of students. This study is expected to be an evaluation for the learning-teaching process in SMA Negeri 1 Kota Mungkid especially in biology lesson so that can help to increase the students' critical thinking.

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