Analysis of Critical Thinking Skills of Senior High School Department of Mipa on Biological Materials with Environmental Socio-Scientific Issues (ESSI)

Alpahmi Aji Satria[1], Sulistyo Saputro[2], Sutarno[3], Harjana[4]

[1,2,3,4]Universitas Sebelas Maret, Indonesia
alpahmi.as@gmail.com

Abstract

This study aims to describe the critical thinking skills of students of class X MIPA SMA Negeri 1 Tiga Dihaji, SMA Negeri 1 Buay Sandang Aji, and SMA Negeri 2 Muaradua. This type of research is descriptive research with a qualitative approach. This research was carried out in class X Mathematics and Natural Sciences (N=124) students by working on the Essay test instrument for critical thinking skills on Environmental Socio-Scientific Issues (ESSI)-based biology material. The results showed that students' critical thinking skills were still very lacking, namely in the interpretation aspect 44.95% with very poor criteria, analysis aspect 40.12% with very poor criteria, 49.79% evaluation with very poor criteria, and 40.72% inference aspect with very poor criteria.

I. Introduction

The development of the era of globalization, science, technology and information is still a challenge in the 21st century. These challenges require competent human resources to face global competition. Competencies that must be prepared are individual abilities in creative thinking, critical thinking, independence, working with teams, creativity, information, communication and independent learning. The importance of higher order thinking skills in the 21st century is a priority for educators in achieving educational goals. High-level skills must be prepared by students because they are one of the skills to produce quality human resources. One of the high-level skills is critical thinking. Development is a systematic and continuous effort made to realize something that is aspired. Development is a change towards improvement. Changes towards improvement require the mobilization of all human resources and reason to realize what is aspired. In addition, development is also very dependent on the availability of natural resource wealth. The availability of natural resources is one of the keys to economic growth in an area. (Shah, M. et al. 2020).

1.1 Critical Thinking Skills

The education system has highlighted the importance of every citizen acquiring the skills necessary to participate in an ever-changing and increasingly complex world. Thus, critical thinking is considered important to strengthen democracy and enable citizens to actively participate in preparing for economic improvement, social life and academic learning. (Behar-Horenstein & Niu, 2011; Wilson, 2016).

Critical thinkingBy definition, psychology tends to refer to the cognitive skills, mental processes, strategies, and representations that people use to solve problems, make decisions, and learn new concepts. (Robert & Price, 1986). (Angelo, 1995) express critical thinking is a high-level thinking activity which includes activities of analysis, synthesis,

problems and solutions, conclusions, and evaluations. In this sense, critical thinking is understood as a process that focuses on the mental activity required when using skills. This is in line withDwyer et al., (2014) who defines critical thinking as a metacognitive process that, through reflective judgment, increases the likelihood of generating logical conclusions for an argument or solution to a problem.

In the field of education critical thinking is used interchangeably with the concept of higher-order thinking contained in Bloom's taxonomy. Bloom's taxonomy explains that cognitive skills can be classified according to their level of complexity (Cáceres et al., 2020). Critical thinking is a directed and organized assessment that results in interpretation, analysis, evaluation and conclusions and seeks to ensure the truth in an argument (Akpur, 2020). According to Sharadgah (2014) the critical component.

Ennis (1996) Categorize critical thinking into 6 aspects, namely focus (the ability to clarify a question or issue to make a decision); reason (able to make decisions against or support by looking at the basic reasons according to the situation and relevant facts); inference (able to make conclusions from various reasons). taken correctly); situation (capable of understanding and maintaining situations in thinking, solving, clarifying either in the form of questions or important terms as relevant parts to be used); clarity (able to explain things in detail from the various terms used); and overview (able to review the decisions that have been taken).

Facione (2015) suggests that the core of critical thinking skills includes interpretation, analysis, evaluation, inference, explanation, self-regulation.

Figure 1. Aspects of Critical Thinking (Facione, 2016)

Of the six critical thinking skills, the researcher emphasizes that the most preferred indicator is the ability to evaluate and inference because these abilities require reflective and logical thinking. Apart from the indicators that are considered the most important by researchers in critical thinking, this is also supported by (Ruggiero, 2012; Peter, 2012; & Snyder & Snyder, 2008) which states that the core of critical thinking skills is evaluation. Thus, of the six indicators of critical thinking ability, researchers only focus on the 4th indicator, namely interpretation, analysis, evaluation, inference.

Critical thinking skills are needed to improve learning achievement and decide all problems both through information found by checking the truth to getting a decision that is considered appropriate or rejected. Learning is a holistic process, culturally constructed and influenced by socio-emotional and contextual so that learning becomes meaningful (Yuliarti, Y. 2021). Contextual-based learning can raise social science issues or known as socio-scientific issues (SSI).

1.2 Socio-scientific issues (SSI)

The involvement of Socio-scientific Issues (SSI) in the learning environment is considered important to remember the environmental situation that has the potential as a new problem, so it is considered necessary to be used as a concept for students' teaching materials to solve existing problems so that the learning carried out can be meaningful. Meaningful learning can occur in students' minds if there is no separation between what is being learned and what will be understood in an environment where issues or problems occur.

Context-based learning describes an approach in science education that seeks to make learning meaningful for students. One of the learning contexts that is starting to be in great demand in science education research in the world today is the use of socioscientific issues (SSI). SSI-based learning is stated as a strong strategy to encourage students' interest in literacy development, especially scientific literacy.

Socio-scientific Issues (SSI) requires practice and experience in developing scientific thinking habits including maintaining an open mind, generating critical thinking, recognizing various forms of inquiry, accepting ambiguity, seeking data-based knowledge. (Zeidler et al., 2005). SSI is the intentional use of science topics so that they can engage in dialogue, discussion, and debate related to science (Anagün & zden, 2010). These topics are basically controversial, dilemmatic and ill-structured, involving the evaluation of moral and ethical aspects (Evagorou et al., 2012; Espeja & Lagaron, 2015). This is in accordance with SSI's understanding that SSI is a socially controversial topic or issue that has a scientific component as well as other disciplines and interests such as politics, economics, ethics, etc. (Sadler, 2011) (Espeja & Lagarón, 2015).

SSI provides an ideal context that seeks to involve students in decision-making regarding social issues with moral implications that exist in a scientific context. The issues in SSI-based learning are open-ended both conceptually and procedurally and allow a rational solution that is influenced by various aspects such as cultural, political, economic and ethical identity. SSI learning encourages students to know how the role of science in the real world by involving evidence in explaining the occurrence of something.

This study aims to determine students' critical thinking skills in biology subjects using essay test instruments with the context of Invironmental socio-scientific issues (ESSI) at SMA Negeri 1 Buay Sandang Aji, SMA Negeri 1 Tiga Dihaji, and SMA Negeri 2 Muaradua with a total number of respondents. 124 students. The existence of this research is expected to provide information and descriptions to teachers about the extent of students' critical thinking skills so that teachers can design learning activities, produce a learning module that can stimulate students' critical thinking, and develop innovative learning models.

II. Research Method

The type of research conducted is descriptive research with a qualitative approach. The level of students' critical thinking skills can be known by using predetermined indicators. The indicators that are measured are interpretation, analysis, evaluation, and inference. The sampling technique used was total sampling consisting of all class X Mathematics and Natural Sciences at three schools, namely SMA Negeri 1 Tiga Dihaji, SMA Negeri 1 Buay Sandang Aji and SMA Negeri 2 Muaradua with 124 students as research respondents.

Essay writing test is used as a data collection technique. The test was given to the research sample respondents with the aim of knowing the level of students' ability to think critically. The test instrument is in the form of biology essay questions in the context of Invironmetal Socio-scientific issues (ESSI) accompanied by an assessment rubric as a guide for scoring on every aspect of critical thinking skills. The results of the measurement data carried out are presented in the form of a percentage score.

III. Discussion

The critical thinking ability test used to collect data consists of 4 aspects of interpretation, analysis, evaluation, inference. Instrument questions in the form of a biology essay test on environmental material. The criteria for grouping critical thinking consist of very good, high, sufficient, less and very poor scores. The criteria for categorizing critical thinking skills can be seen in Table 1.

Table 1. Critical Thinking Skills Criteria Scale

Percentage	Category
86% - 100%	Very good
76% - 85%	Well
60% - 75%	Enough
55% - 59%	Not enough
54%	Very less

(Purwanto, 2007)

Each student is analyzed critically thinking skills on environmental material essay questions. Each question has a score point according to the indicator with a total score of 100. The distribution of the percentage of students' critical thinking ability test results in each school is shown in Table 2, table 3, and table 4.

Tabe 2. Percentage of Critical Thinking Skills SMA Negeri 1 Tiga Hajj

ASPECT	PERCENTAGE	CRITERIA
Interpretation	45.94%	very less
Analysis	38.18%	very less
Evaluation	47.29%	very less
Inference	39.86%	very less

Table 3. Percentage of Critical Thinking Skills SMA Negeri 1 Buay Sandang Aji

ASPECT	PERCENTAGE	CRITERIA
Interpretation	45.56%	very less
Analysis	40.70%	very less

Evaluation	50.40%	Not enough
Inference	39.50%	very less

Table 4. Percentage of Critical Thinking Skills SMA Negeri 2 Muaradua

ASPECT	PERCENTAGE	CRITERIA
Interpretation	42.00%	very less
Analysis	40.00%	very less
Evaluation	52.00%	very less
Inference	45.00%	very less

Tables 1,2, and 3 show that the average level of critical thinking skills of students in three schools is in the very poor category in the aspects of interpretation, analysis, evaluation and inference. A total of 124 students as research respondents showed obstacles in answering the given essay questions. From the findings in the field that the factor that most supports student errors in answering questions is that students are not accustomed to being trained to think critically. Students are only trained in working on problems and solving simple problems that do not force them to do higher-order thinking such as critical thinking. To see the percentage level of students' critical thinking skills as a whole from the 3 schools that were conducted the research can be seen in table 5.

Table 5. Percentage of 124 Students' Critical Thinking Skills

ASPECT	PERCENTAGE	CRITERIA
Interpretation	44.95%	Very less
Analysis	40.12%	Very less
Evaluation	49.79%	Very less
Inference	40.72%	Very less

The results of the critical thinking ability test on 124 students divided into three public high schools in South Oku, South Sumatra province, it was found that students in the three schools in the category of having critical thinking skills were relatively very lacking in the interpretation aspect, 44.95 % with very poor criteria, analysis aspect. 40.12% of the criteria are very poor, the evaluation aspect is 49.79% the criteria are very poor, and the inference aspect is 40.72% the criteria are very poor. More details can be seen in graph 1.
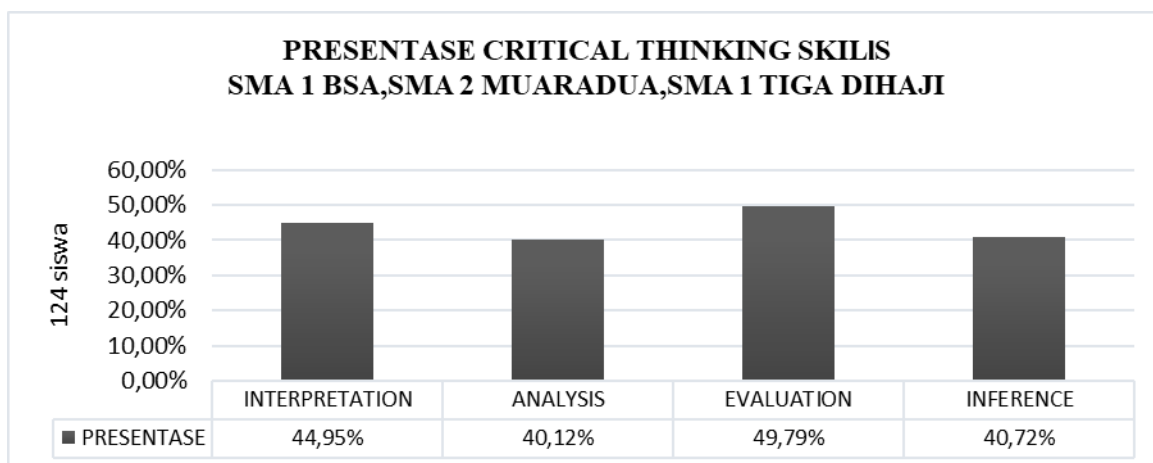
Figure 1. *Graph of the percentage of students' critical thinking skills*

There are three basic aspects that must be met in critical thinking, namely (1) the tendency to approach problems/issues with forward-looking attitudes and ways of thinking, (2) have the knowledge and skills needed for logical reasoning and basic questions, and (3) the ability to apply the knowledge and skills they have in everyday life. Critical thinking requires a great effort to examine every belief or assumptive knowledge based on the supporting evidence and the further conclusions that result.

Based on the analysis of the data obtained, it shows that the average student has critical thinking skills that are still very lacking. Most students experience problems in applying the concept of knowledge in solving problems. The obstacles experienced by students are in line with the findings of researchers in the field. Based on the results of filling out questionnaires by students, students' critical thinking abilities are still not optimal because the learning carried out in the classroom has not empowered critical thinking skills. Students still often memorize every material that is taught and learning resources are still lacking.

From the problems found, the most important indicator of problems is learning activities that are not optimal, such as the need to use learning models that can train and improve critical thinking skills. Snyder & Snyder (2008) revealed that students are not able to solve problems because their critical thinking skills are still low. The habit of students in memorizing makes students think a little and a little in mastering concepts. Students' critical thinking skills will be optimal if they do exercises in learning activities.

Exercise requires a learning module that stimulates students to think about the problems they face and the use of learning models that are able to direct effective learning activities. If the critical thinking skills training is carried out properly, it will increase students' confidence and foster student interest in solving problems so that learning outcomes can be maximized. According to (Agboze & Ugwoke, 2013;Magdalena et al., 2021)Critical thinking skills can be improved by applying strategies that have the characteristics of involving active interaction from students and using their cognitive abilities in applying concepts and solving problems.

Critical thinking skills can also be improved by asking questions of an investigative nature, encouraging students to solve problems and making conclusions based on investigations(Puritasari et al., 2020). The development of critical thinking skills is carried out by teachers by training critical thinking skills and facilitating learning activities with critical thinking indicators. Siyang who has the ability to think critically will be able to make wise decisions by giving various critical reasons. Therefore, someone who has the ability to think critically will always analyze SSI problems that are encountered later

Solutions that can be done to overcome the problem of lack of fulfillment of critical thinking skills indicators are by conducting training that can be realized in the school curriculum and choosing innovative learning models. Therefore, there is a need for a learning model that is in accordance with the need to train critical thinking skills during learning activities

IV. Conclusion

Based on the results of the study, it can be concluded that the analysis of students' critical thinking skills in class X science at SMA Negeri 1 Tiga Dihaji, SMA Negeri 1 Buay Sandang Aji, and SMA Negeri 2 Muaradua obtained the percentage of achievement of each aspect of critical thinking skills, namely the interpretation aspect 44.95%, analysis 40.12%, evaluation 49.79% and inference 40.72% with very poor criteria. The students' critical thinking ability which is still very lacking is due to the lack of learning that is applied in empowering students' ability to think critically. The application of learning in improving students' critical thinking requires a learning module that can stimulate students' critical thinking and innovative learning models.

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