
THE EFFECTIVENESS OF CRITICAL THINKING ABILITY ON STUDENT COGNITIVE LEARNING OUTCOMES

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ABSTRACT

This purpose of this study is to determine: differences in cognitive learning outcomes of students who have high critical thinking skills and low. The study population was students of X science class in one of the state high schools in Lombok Tengah Regency, NTB, Indonesia, which amounted to 18 schools. The research sample was selected by purposive random sampling. Cognitive learning outcomes and critical thinking are measured using essay tests. The results of testing the validity and reliability of tests of cognitive learning outcomes and critical thinking show valid and reliable results. Data were analyzed using One-Way ANOVA. The results showed that: there is a significant difference in cognitive learning outcomes between students who have high critical thinking skills and low critical thinking skills. Student cognitive learning outcomes are higher in students with high critical thinking than students with low critical thinking.

KEYWORDS: Cognitive Learning Outcomes, Critical Thinking

1. INTRODUCTION

The 21st century is marked by the rapid pace of information and the rapid development of technology (Putra et al., 2018). Changes and developments in information and technology are so fast that a person needs to have certain skills one of which is critical thinking skills (Hadiati et al., 2019; RS Wardani, L. Lindawati, 2017; Sümen, 2017). Critical thinking is one aspect of higher-order thinking skills (Sahoo and Mohammed, 2018). Critical thinking skills are needed by someone in evaluating the truth of information before it is used in decision making (Putra et al., 2018). Critical thinking training is also needed for supporting the success of learning Biology (Y. Bustami, D. Syafruddin, 2018).

Critical thinking skills are cognitive processes related to the ability to evaluate the information for decision making, problem-solving or inquiry (Alazzi, 2004). The development of critical thinking skills in students requires time and training processes. The training process in question is the use of learning methods or other relevant strategies (Fern et al., 2019).

The results of the 2015 PISA (Program for International Student Assessment) Survey place the high-level thinking skills of Indonesian students ranked 62 out of 69 countries evaluated (Prayitno et al., 2019; Prayitno and Suciati, 2017). Many studies have convinced that students' critical thinking skills in Indonesia are of concern (Khasanah et al., 2017; Suratno, 2017; Prabowo, 2015). The low critical

thinking skills of students in Indonesia are one of them due to the use of learning methods that emphasize memorization less encouraging students to conduct proving activities or conduct investigations (Prihatni et al., 2016; Suratno, 2017).

The results of observations made by researchers at the study site indicate that teaching and learning activities are dominated by the use of lecture methods by teachers. So it has an impact on the low cognitive learning outcomes of students. Many studies have shown that Indonesian students' biology learning outcomes are very low (Deta et al., 2013; Prabowo, 2015; Rusmiyati & Yulianto, 2009). Learning using the lecture method does not allow students to think and participate actively, it only trains the ability to memorize so that students do not develop their ideas and critical thinking skills (Putra et al., 2018; Hayes and Devitt, 2008). Learning biology using the lecture method provides fewer opportunities for students to be active in learning, less interaction between teacher and student, more listening, note-taking, resulting in low cognitive learning outcomes and less developing students' critical thinking skills (Labibah and Ernawati, 2017).

Based on the low cognitive learning outcomes of students shows the gap between the world of education with conditions in the field. The low cognitive learning outcomes of these students can be caused by a variety of factors which can be from a teacher, student, or other learning support factors. Teachers play an important role in improving student cognitive learning outcomes (Peppen et al., 2018). Teaching and learning processes are carried out so that students are able to construct, discover and develop their own ideas (Prayitno et al., 2019). Biology learning emphasizes the process of discovering Biology products (Putra et al., 2018; Abdullah Syifa, 2015). Biology learning must be carried out with processes that make students active and facilitate students to achieve cognitive learning outcomes (Azizah et al., 2018).

Cognitive student learning outcomes may be influenced by the level of students' initial critical thinking skills. Changwong's opinion, (2018) that critical thinking is identifying problems, thinking about goals and finding possible solutions. Students have different critical thinking abilities caused by variations in the ability of each individual (Prayitno et al., 2017). Students' different thinking abilities will contribute to different learning outcomes. Based on the description that has been described, this study aims to examine: differences in cognitive learning outcomes of students who have high critical thinking skills and low critical thinking.

2. METHODS

This research is a quasi-experimental study. The study population was students of class X science in one of the state high schools in Central Lombok regency, NTB, Indonesia, totaling 18 schools. The research sample was selected by purposive random sampling. The study was conducted from March 09 to November 18, 2019. Student cognitive learning outcomes were tested at the end of learning. Critical thinking ability as a moderator variable is tested before treatment for the classification of

high critical thinking skills and low critical thinking skills of students. Classifying students' high and low critical thinking skills using the normal curve reference.

Cognitive learning outcomes and critical thinking skills of students are measured using essay tests. Indicators of cognitive learning outcomes refer to Bloom (2001) including the ability, (1) remembering, (2) understanding, (3) applying, (4) analysis, (5) assessment, (6) creating. Critical thinking indicators refer to Facione, (2011) which consists of 6 indicators such as (1) Interpretation; (2) conclusion; (3) evaluation; (4) explanation; (5) analysis; and (6) self-regulation.

Two experts were involved in testing whether the assessment was suitable for measuring indicators of cognitive learning outcomes and critical thinking and whether they were consistent with learning material. After analyzing, the experts stated the instrument of cognitive learning outcomes was valid with an index of the validity of 3.65 and critical thinking 3.45. The assessment was given to 26 students of class X IPA in one of the state high schools in Central Lombok, NTB, Indonesia, as a trial. The results of empirical tests of cognitive learning outcomes indicate that the assessment is valid with a validity index of 0.37-0.79 and critical thinking 0.40-0.86. The reliability index was tested using the Cronbach alpha formula. The results showed that the assessment of cognitive learning outcomes with a reliability index of 0.88 and critical thinking of 0.75. Data were analyzed using one-way ANOVA. Statistical calculations were measured using SPSS version 18.0 with a significance level of 0.05.

3. RESULTS

Before the data analysis test is performed, the prerequisite test is performed first. The prerequisite test is a test for normality and homogeneity. The normality test uses Kolmogorov-Smirnov and homogeneity test with Lavene Test. Data on normality test results are presented in Table 1.

Table 1. Normality Test

	Critical Thinking Skills	Kolmogorov-Smirnov ^a		
		Statistic	df	Sig.
Learning Outcomes	High	.161	29	.053
	Low	.117	24	.200*

According to the results of the normality test using the Kolmogorov-Smirnov test. The test results show that the cognitive learning outcomes data on high critical thinking students is 0.053 and the cognitive learning outcomes on low critical thinking students are significantly 0.200 results, higher

than the alpha level of 0.05. This means that the sample data does not deviate from the normal distribution. The homogeneity of the variance tested using the Levene test is presented in table 2.

Table 2. Homogeneity Test

Levene Statistic	df1	df2	Sig.
1.047	1	51	.311

In table 2 it is known that the homogeneity test is using the Lavene Statistics test and it shows that the homogeneity of the variance is 0.311, higher than the alpha level of 0.05 or that means homogeneous research data.

After the prerequisite tests can be fulfilled, the next stage is the hypothesis testing stage using the one-way ANOVA test. Based on the results of the one-way ANOVA test results obtained by 0,000. Based on the decision norms set at $0,000 < 0.050$, it is stated that there are significant differences in cognitive learning outcomes in high critical thinking students and low critical thinking. One-way ANOVA test results for data on cognitive learning outcomes in critical thinking are presented in Table 3.

Table 3. One-Way ANOVA Test Results in The Influence of Critical Thinking Skills is Different on Cognitive Learning Outcomes

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2963.781	1	2963.781	28.630	.000
Within Groups	5279.540	51	103.520		
Total	8243.321	52			

Based on table 3, significant critical thinking is sig. = 0,000, less than the alpha value = 0.05 (< 0.05), which means that critical thinking significantly influences students' cognitive learning outcomes. Correction scores of the average cognitive learning outcomes in different critical thinking are presented in Table 4.

Table 4. Cognitive Learning Outcomes In Students Who Have High and Low Critical Thinking Skills

Critical Thinking Skills	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
High	29	80.69	9.625	1.787	77.03	84.35
Low	24	65.67	10.805	2.206	61.10	70.23

Table 4 shows that the average correction score on cognitive learning outcomes in high critical thinking students is 80.69 and in low critical thinking students is 65.67. This shows that the cognitive learning outcomes of high critical thinking students are different from those of low critical thinking students. High critical thinking students have better cognitive learning outcomes than low critical thinking students. A comparison of the frequency of cognitive learning outcomes in high critical thinking and low critical thinking is presented in Figure 1.

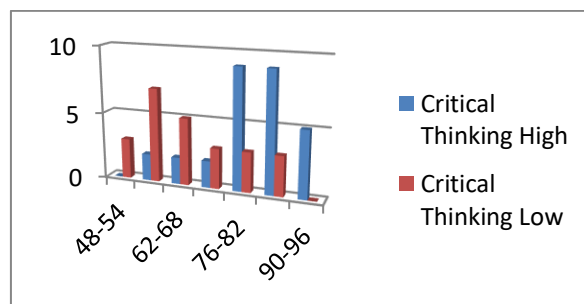


Figure 1. Comparison of The Frequency of Cognitive Learning Outcomes in High and Low Critical Thinking

4. DISCUSSION

Table 3 illustrates the correlation between significant differences between critical thinking and cognitive learning outcomes. Table 4 shows that students with high critical thinking have higher cognitive learning outcomes compared to students with low critical thinking. The students are categorized into two groups: high critical thinking and low critical thinking. High critical thinking students have a better ability to accept learning, faster understanding of the material delivered compared to low critical thinking students. With these skills, high critical thinking students will

understand learning well, thus cognitive learning outcomes are significantly higher than low critical thinking.

This can be seen from the average value of cognitive learning outcomes in high critical thinking students is 80.69 and low critical thinking students with an average of 65.67. Shows that students with high critical thinking get better learning outcomes than students with low critical thinking. In line with the results of research Abidin et al., (2018) that students who have high critical thinking skills have an average better learning outcomes than students with low critical thinking. This is because students who have high critical thinking ability are more active in participating in learning, have greater curiosity, can solve problems and can draw conclusions well and are more confident in the learning process. While students who have low critical thinking skills are less active in participating in learning, lack of confidence in conveying opinions or ideas, and less quick in accepting material delivered by the teacher. Critical thinking is very important for student learning outcomes (Perry et al., 2014). Low learning outcomes indicate that students' critical thinking skills are still low (Kurniahtunnisa et al., 2016). Students who have high critical thinking skills will have the ability to explain information clearly, analyze, and evaluate (Anazifa, 2017). Students who think critically will be able to make decisions and solve problems (Syarifah and Sumardi, 2015).

Critical thinking is a cognitive strategy that is used to effectively solve a problem (Foo and Quek, 2019). Critical thinking involves activity, such as analyzing, synthesizing, making consideration, creating and applying new knowledge to the real world (Hatari et al., 2016). Facione, (2011) states indicators of critical thinking skills include ability in, (1) interpreting, (2) concluding, (3) evaluating, (4) explaining, (5) analyzing, and (6) self-regulation. With critical thinking skills, students can be rational and choose the best alternative for themselves (Inerney and Baird, 2016). Before making a decision, one must collect, analyze, evaluate and synthesize the information needed (Arazo et al., 2018).

5. CONCLUSION

The conclusion of this study shows that there are significant cognitive outcomes of students with high and low critical thinking on cognitive learning outcomes of students with Archaeobacteria and Eubacteria material that were experimented on in class X IPA at SMAN 3 Praya Tengah, Central Lombok Regency, NTB. Based on the results of research that students' cognitive learning outcomes seen from high critical thinking skills and low critical thinking show that high critical thinking students have better cognitive learning outcomes than low critical thinking students.

Suggestions for teachers so that the use of practice questions or for examinations are driven by indicators of higher-order thinking to practice students' abilities in critical thinking. Not only Archaeobacteria and Eubacteria, but students' critical thinking skills can also be used in other Biology learning materials. Suggestions for further research to pay more attention to the critical thinking skills of each student and can add other variables.

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