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Research Article – Education

The correlation between critical thinking and the learning results of the senior high school students in biology learning implementing group investigation (gi) learning in Malang, Indonesia

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Abstract

The students' biology learning results may vary among student, caused by several variables affecting the students' learning results, such as, learning style, critical thinking, metacognitive skills, learning models and some others. Many researches have investigated the correlation between critical thinking and students' learning results. However, a research investigating the correlation between critical thinking and learning results in Group Investigation (GI) learning has not been conducted. This research aims at investigating the correlation between the critical thinking and the learning results of senior high school students in Biology learning implementing the Group Investigation (GI) learning in Malang. This research was conducted in 2015 from July until December, using correlational design. The population of this research was all senior high school students in Malang. The subjects of this research were 32 students of class X MIA 2, and 33 students of class X MIA 4 of St Mary senior high school Malang. Data were analyzed using simple linear regression analysis. The results of this research showed that there was a correlation between students' critical thinking and their learning results with the regression equation of the correlation between the two variables Y = 0.988X + 0.095, having a reliability value of 73.9%.

Key words: Biology learning, critical thinking, Group Investigation, learning results

Introduction

In this globalization era, the challenge of quality improvement in all aspects of life is not negotiable. The rapid development of science and technology (Science and Technology) encourage all nations to utilize their full potential of the mind and resources in order to obtain the equal opportunities in various aspects of life. Therefore, the present education should be directed at improving the competitiveness of the nation in order to compete in the global competition. The learning process in the 21st century emphasizes on the concept of critical thinking and it should be owned by all components in the learning process, both by teachers and by students. Critical thinking is now becoming one of the important goals of education (Bart, 2010). Critical thinking is an important and vital topic in modern education (Schafersman, 1991).

Today, the Partnership for 21st Century Skills has identified that critical thinking is one of the necessary skills to prepare the students for their education career and the work life. Common Core State Standards states that critical thinking is an interdisciplinary subject that is very important for students and workers (Lai, 2011). Critical thinking skills are also stated as one of the fundamental assets or intellectual assets which are very essential for everyone, and it is, therefore, a fundamental part of human maturity (Liliasari, 2001).

In connection with the critical thinking skill, it was stated that if we wanted to encourage students' thinking skills, the learning activities and the evaluation must be deliberately managed to

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support those interests (Corebima, 2006). In this case, the implementation aspects that must be considered are the approach, strategies, methods, and the other learning techniques.

Furthermore, optimizing students' critical thinking skills on the subject matter, the use of language, the use of logical thinking structure, knowledge testing, and the experience of various aspects would enable them to be independent students (Paul, 1990). This Intellectual independence is important to be possessed by the students in addition, to courage, decency, and faith because the students will become moralist and responsible persons in society.

The biology learning results of one student with the others may vary. This condition is because there are several variables that can affect students' learning results, such as learning styles, critical thinking skill, metacognitive skill, learning models and the others. Among these variables, critical thinking has the greatest possibility affecting the students' biology learning results.

A number of experts explain that critical thinking has a significant contribution on students' learning results. Thinking is the center of all knowledge. Furthemore thinking was connecting the parts of the knowledge got by human (Soemanto, 1990). There were other statement saying that critical thinking was active, constant, and meticulous considering about the belief or knowledge viewed from the supporting reasons and the conclusions related (Fisher, 2001), and critical thinking was the process of using the cognitive skill and strategies to increase the possibility to achieve the goals (Halpern, 2013). This process involved problem solving, formulating the affecting factors, calculating various possibilities, and making a decision. A number of researches found that critical thinking was a higher-order thinking skill, and was known to play a role in the moral, social, mental, cognitive, and science development (Hashemi, 2010).

Related to the correlation between critical thinking skills and biology learning results, the research results conducted before showed that there was a correlation between critical thinking skills and learning results implementing project-based learning having the regression equation of Y = 1,014X - 0.761 with a reliability score of 0.734, so the cognitive learning results could be explained by using the critical thinking variable as much as 73, 4% (Surachman, 2010). A similar research conducted before showed too that the critical thinking skill had a contribution of 41, 99% on the cognitive learning results of the senior high school students in Malang in the implementation of reciprocal teaching strategies (Wicaksono, 2014). Another research showed that there was a positive correlation between metacognitive skills and critical thinking skills with learning results in the implementation of PBL learning, where relative and effective contribution of the critical thinking skills on the learning results as much as 61.53%, and 46.16% respectively (Malahayati, 2014). Furthermore, another research also showed that there was a positive correlation between critical thinking and students' cognitive results, so that the students having high critical thinking skills would also had high learning results (Cano and Martinez, 1991). Similarly, there were also another research report showing that critical thinking skill had a positive correlation with the students' learning results (Dehghani, 2011).

A specific study related to the correlation between critical thinking skill and the learning results based on the corrected score of the posttest scores in biology learning will possibly give better information about how the critical thinking variables can explain the learning results. Such information is very important for the implementation of education process and other related research. A simple linear regression of the correlation between critical thinking and learning results would be better if it is done in a particular learning model. Each learning model has different characteristics and advantages. Therefore, the learning results obtained for each different learning model might vary, and so is the simple linear regression equation.

One of the cooperative learning that can be used is the Group Investigation (GI) learning. GI was a cooperative learning emphasizing on the students' participation and activities to find their own information that will be learned from the available materials, for example from the textbook or the internet (Narudin, 2009). GI learning consists of six stages: choosing the topic, planning

tasks, conducting investigations, analyzing and preparing the report, presenting the final report, and evaluating (Sharan, 2004). GI learning is considered to be the solution because it is proved that it has the advantages to enhance the students' active involvement from the beginning stage until the final stage, and is able to improve the cognitive aspect, affective aspect, as well as scientific skills.

The implementation of GI learning in the learning process has been done by several researchers and has been proven to improve students' learning results. Several previous researches have reported that the implementation of GI learning can improve students' learning results (Rahmawati, 2012; Pertiwi, 2013). However, the correlation between critical thinking and learning results based on the corrected score of the senior high school students in biology learning in the implementation of GI learning has not been revealed yet.

This research aims at determining the correlation between critical thinking and the learning results of the senior high school students based on the corrected score between pretest and posttest in biology learning implementing GI learning in Malang. The research was conducted in 2015, from July until December.

Research Methods

The research was carried out in a descriptive-correlational research, and the data were analyzed using simple linear regression analysis. This research used the critical thinking variable as the predictor and the learning results as the criterion, the control variable was the Group Investigation learning. The correlation between the predictor and criterion is shown in Fig. 1.

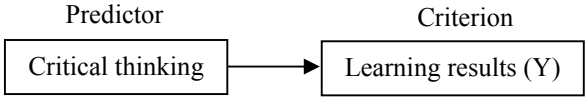

Figure 1. The Correlation Between Critical Thinking and Learning Results

The population of this research was all of class X students of senior High School in Malang, in the first semester of the 2015/2016 Academic Year. The samples of this research were the students of class X MIA of St Maria senior high school Malang, which were selected by simple random sampling technique. Two classes of the four MIA X classes of the St Maria senior high school Malang were selected based on the equality test results, using the ANOVA test. The two classes (Class X MIA 2 and Class X MIA 4) consisted of 32 and 33 students respectively.

The instrument used in this research consisted of two kinds, namely the learning instruments, and the instruments to measure the research variables. Learning instruments consisted of: 1) syllabus, 2) lesson plan, and 3) the students' worksheet. While the instruments used to measure the research variables were: essay test, in the form of open questions, used to obtain the data of the learning results, and the students' critical thinking using the rubric developed by Finken and Ennis that has been adapted (Zubaidah *et al.,* 2015). The data were obtained by the pretest and posttest. The data were then analyzed by using simple linear regression test based on the corrected score of posttest using SPSS software for Windows ($\alpha = 0{,}05$).

Results

The Correlation between the students critical Thinking and their Learning Results of Class X MIA 2 and Class X MIA 4 based on the corrected Score.

The correlation between critical thinking and the learning results of the students of class X MIA 2 and class XMIA 4 based on the corrected score can be seen in Table 1 - 3.

The results of the analysis (Tables 1 - 3) show that, there is a correlation between critical thinking and the learning results of the students of class X MIA 2 and class X MIA 4 in the Group investigation class. The results of the regression test show that critical thinking has a contribution on the learning results as much as 73.9%, while the other 26.1% is the contribution of the other factors. The linear regression equation based on the data analysis was $Y = 0{,}988X + 0.095$. The graph of the correlation between the critical thinking and the learning results in the implementation of group investigation (GI) learning model can be seen in Fig. 2.

Table 1. ANOVA Table of the Correlation between critical Thinking and the Learning Results of the Students of Class X MIA 2 and Class X MIA 4 based on the corrected Score

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	103.555	1	103.555	178.253	.000 a
	residual	36.599	63	.581		
	Total	140.154	64			

Table 2. The Regression Table of the Correlation between critical Thinking and the Learning Results of the Students of Class X MIA 2 and Class X MIA 4 based on the Corrected Score

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.860 a	.739	.735	.76219

Table 3. The Regression Equation Coefficient of the Correlation between critical Thinking and the Learning Results of the Students of Class X MIA 2 and Class X MIA 4 based on corrected score

Model		Unstandardized Coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	beta		
1	(Constant)	.095	.144		.661	.511
	Corrected Critical Thinking	.988	.074	.860	13 351	.000

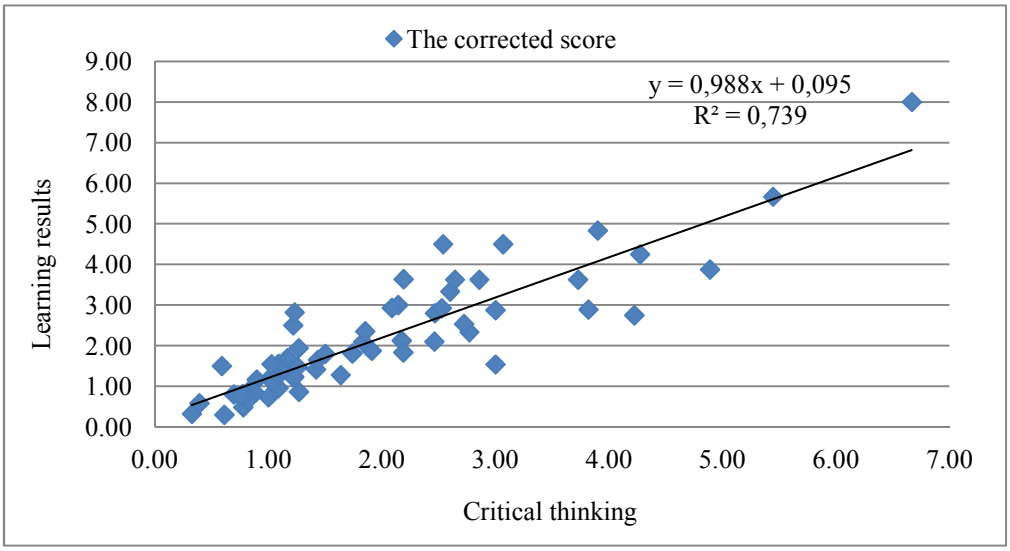

Figure 2. The linear regression line of the correlation between critical thinking and the learning results of student based on the corrected scoree

Discussion

Based on the results of data analysis it can be seen that the critical thinking has a significant contribution on the learning results having the reliability value of 73.9%. The results of this research are consistent with results of previous research, showing that there was a correlation between critical thinking skills and learning results in the project-based learning with the regression equation Y = 1,014X - 0.761 having the reliability value of 73.4% (Surachman, 2010); and the another research results showed that the critical thinking had a contribution as much as 41, 99% on the cognitive learning results in the implementation of reciprocal teaching strategy on senior high school students in Malang (Wicaksono, 2014). A similar research Malahayati (2014) showed that the effective contribution of the critical thinking

on the learning results as much as 46.16%. The results of the other similar research Cano and Martinez (1991) showed too that there was a positive correlation between the critical thinking score and the students' cognitive learning results, so that students having high critical thinking skills would also have high learning results; and another report also showed that critical thinking had a positive correlation with the students' learning results (Dehghani, 2011).

Critical thinking is the fundamental asset or intellectual asset which is very important for everyone, as well as is a fundamental part of human maturity (Liliasari, 2001). Furthermore, it was stated that optimizing students' critical thinking skills upon subject matter, use of language, the use of logical thinking structure, testing the truth of knowledge, and the experience of various aspects would make the students become independent learners (Paul, 1990). Furthermore it was said too that critical thinking was related to the use the cognitive skills to improve the possibility of achieving the goals (Halpern, 2013). The process also includes problem solving, formulating influential factors, calculating the various possibilities, and making a decision.

The results of field observations show that the implementation of Group Investigation learning model during the learning activities can create a good learning environment, so that the learning objectives can be achieved as expected. In addition GI models take into account all the conditions of students, both internal and external, because GI model combines some views, namely the constructivistic view, democratic teaching, and cooperative learning. Based on the constructivistic view, the Group Investigation model provides greater opportunities for students to be involved directly and actively in the learning process of a topic through investigation. Moreover, there was a perception saying that GI learning model was a cooperative learning strategy, in which students were actively involved in planning the learning activities, and did not only receive information (Sharan & Sharan, 1990). From these statements, it was concluded that the GI learning model made the students to be accustomed of finding information by themselves through investigation activities they did together (Daniel, 2008). Students work together in forming their groups, determining the topic, planning their work, conducting investigations in accordance with their respective duties, analyzing and summarizing the results and finally, the students presenting their findings to the whole class in front of the class.

GI learning model can train the students to empower their thinking skills independently. The students' active involvement can be seen from the first stage until the final stage of the learning activities. It was said that GI learning model consisted of six stages: choosing the topic, planning tasks, conducting investigations, analyzing and preparing the report, presenting the final report and evaluating (Sharan, 2004). Group Investigation learning model is considered to be the solution because it has the advantages enhancing the students' active involvement starting from the first stage until the final stage, and improving cognitive aspect, affective aspect, and scientific skills in balance.

In relation to critical thinking in the learning process, students must be continually trained on their problem solving skill, decision making, and should continue learning so that their critical thinking skills could be empowered in the learning process (Bart, 2010). Furthermore, it was said that critical thinking was an organized process involving mental activity which included the ability to formulate the problem, give arguments, make observations and write a report, do the deduction, induce, evaluate, decide and implement, as well as interact with the others to solve a problem (Arnyana, 2004). Critical thinking activities are strongly correlated with the mental activity in problem solving. In the 21st century, the concept of critical thinking globally became the main education objective in the classroom, and it should be owned by all components in learning, both teachers and students. Based on this study result it is clearly seen we know that critical thinking is the fundamental asset or intellectual asset, and therefore a fundamental part of human maturity,

which when maximized by the students, it will give a positive contribution on the learning results.

Conclusion

Based on this study results, it can be concluded that there is a correlation between critical thinking and learning results based on the corrected score of the senior high school students in biology learning implementing GI learning model in Malang. The regression equation of the correlation between the two variables is Y = 0,988X + 0.095 having the reliability value of 73.9%.

Suggestion

It is suggested that further researches need to be conducted to confirm the results of this present research. Those further researches need to implement another learning model

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