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The Correlation between Metacognitive Skills and Critical Thinking Skills toward Students' Process Skills in Biology Learning

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Abstract

The purpose of this correlational research was to determine the correlation between metacognitive skills and critical thinking skills toward the process skills of Senior High School students through the implementation of inquiry, REACT, and inquiry integrated with REACT learning models. The population of this research was all students of class X Senior High Schools in Malang in the 2017/2018 academic year. The samples used in this research were the class X students of Science 1 of Senior High School 8 Malang, Science 2 of Senior High School 8 Malang, and science 3 of Senior High School 5 Malang. The research data were analyzed by using multiple regression correlation analysis. The results of this research show that there is a correlation between metacognitive skills and critical thinking skills toward the students' process skills through the implementation of the Inquiry learning model, REACT and INREACT. The contributions of metacognitive skills and critical thinking skills toward the students' process skills through the implementation of Inquiry, REACT and INREACT learning models are 64,7%, 81,3% and 72,5% respectively. This indicates that the effective contribution through the REACT learning model is higher than that through the Inquiry and INREACT learning models.

1. Introduction

Biology education has three aspects that become the goals of science learning and cannot be separated, namely process, product and attitude. This means that in science learning all aspects should be balanced, not only the aspect of knowledge is developed, but process skills and attitudes must also be developed (Wenno, 2008). Science learning is closely related to scientific performance that can be developed through direct experience in the form of investigations and experiments. This is to train science process skills and develop knowledge as an effort to achieve learning success (Rusmiyati & Yulianto, 2009).

Learning success should not only be about the final learning results of learning activities, but it should also be about the students' abilities or the process skills during the learning process (Semiawan, 1989). The role of the teachers is very important to guide and to empower the students' skills including improvement of their process skills to achieve success in learning. By using process skills, students apply more meaningful learning through the concept of the scientific method, find and develop facts and concepts, both contextual and constructivistic (Suparno, 2001).

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Meaningful learning using the scientific method concept are learning activities that involve experimentation and discovery to prove if an answer is correct, so that there is potential to improve the students' knowledge and skills in learning (Ministry of Education and Culture, 2014; Unal & Ozdemir, 2013). This is in line with Wahyudi (1996) stating that the students' learning not only required them to understand concepts, but it also required them to do the process to find the concepts. The realization of these skills is in the form of the students' ability to use process skills to identify daily problems and to overcome these problems by determining the appropriate hypothesis (Hmelo-Silver, 2004).

Process skills in learning will be more meaningful when students' critical thinking skills and metacognitive skills are optimally developed. This is because process skills are the skills used to acquire knowledge or the skills to use the knowledge they have in solving problems, and the skills to formulate the results of problem solving (Padilla, 1990). This is in line with Ozgelen (2012) who states that science process skills are the skills used to build knowledge in order to solve problems and to formulate the results. Students can use their thinking ability reflectively and logically to develop their knowledge and to trigger their activeness to do various experiments as an effort to improve their process skills in science learning (Fogarty & McTighe, 1993; Kaya, Bahceci & Altuk, 2012). The students who have good metacognitive skills will be successful in learning, because it will develop them to become independent learners and to be able to control their cognitive processes including thinking skills (Schraw & Dennison, 1994).

In addition to metacognitive skills, there are other factors that need to be considered, that is the critical thinking skills. The empowerment of metacognitive skills will have an impact on the the improvement of critical thinking skills. This is in line with the statement of Eggen and Kauchak (1996) that there is a correlation between metacognitive skills and critical thinking. The students supported by their metacognitive skills can learn about the thinking processes and implement specific learning strategies to think independently through difficult tasks (Slavin, 2000). The empowerment of learning process will be more meaningful if the critical thinking skills are also optimally developed. Critical thinking is a cognitive process and an activity used to acquire knowledge. Liliasari (2000) stated that critical thinking was a high-order thinking activity. Critical thinking activates the skills of analyzing and evaluating evidence, identifying questions, making logical conclusion, understanding the implications of arguments (Friedrichsen, 2001).

To date, there have been several previous research studies examining the correlation between metacognitive skills and critical thinking skills toward other variables, such as learning results, learning interests, learning styles and students' characters. The research examining the correlation between metacognitive skills and learning outcomes shows that metacognitive skills has a significant contribution toward students' learning results (Zen, 2010; Fauziyah, 2013). Other research conducted to determine the correlation between critical thinking skills and learning results showed that there was a positive correlation (Dewi, 2008; Samiati, 2012; Yakobus, 2016). Furthermore, the research on the correlation between critical thinking skills and reading interests obtained a positive correlation, and reading interests had a large contribution toward students' critical thinking skills (Hawkins, 2012; Hosseini, et al., 2012; Nasirahmmadi, 2014; Purba, 2013). Further research examines the correlation between metacognitive skills and critical thinking skills with other variables, such as students' learning results at the implementation of different learning strategies. The results of research studies show that metacognitive skills and critical thinking have a significant influence on students' learning results (Malahayati, 2014; Wicaksono, 2014). Another research conducted by Maria (2016) reported that metacognitive skills and critical thinking skills had a correlation with students' character.

Based on previous research, there have not been any studies which specifically examine the correlation between metacognitive skills and critical thinking toward students' science process skills in biology learning. Thus, this research was conducted to see the multiple correlation between metacognitive skills and critical thinking skills toward the students' process skills. In order to be more effective in measuring the correlation between these variables, the appropriate

learning models should be implemented, and it should be oriented on the students' activeness to achieve the expected learning results (Yulaikah, et al., 2015). The appropriate learning model used in this study was the inquiry learning, REACT, and inquiry integrated with REACT (INREACT)

Inquiry learning is an effective learning model that can help students empower their knowledge and process skills (Dimyati & Moedjiono, 2009; Yager & Akcay, 2010). Inquiry learning focuses on describing, explaining, predicting, and communicating scientific phenomena (Carlson, 2008; Harrison & Treagust, 2000). Inquiry learning trains the students to be accustomed to collecting information, exploring, solving problems and discovering new insights (Mei, 2007). Inquiry learning focuses on scientific inquiry, and can help students to develop a deep understanding of learning material, and develop process skills which are essential to the development of scientific literacy, and provide valuable context for the students to obtain, clarify and apply the understanding of scientific concepts (Chabalengula & Mumba, 2012). Learning in real life situations through investigations is very important for students to apply the knowledge they have learned to solve problems (Qablan et al.,2009).

Learning will be more meaningful in empowering process skills which is supported by critical thinking skills and metacognitive skills when the process is carried out by empowering the students learning in togetherness (Ordonez, 1996). Similarly, the (Indonesian) Ministry of Education (2002) and Johnson (2007) also stated that one of the principles in contextual learning (Contextual Teaching and Learning) was a learning community, that was learning based on solidarity, which meant that the members interacted with each other in groups to understand the issues being discussed. Therefore, the students' process skills in learning can be done by applying learning community based learning strategy. One of the contextual learning which is expected to empower students' metacognitive skills and critical thinking skills to support the empowerment of process skills is the REACT learning model. REACT learning model is a learning model which includes the activities of association, experience, application, group-work, and transfer (Rohati, 2011); through this learning, the students rely on the understanding of meaning, to establish the appropriate concepts (Trianto, 2007). In this connection the students rely on their thinking skills to understand and define an appropriate concept, and to work together in groups to apply these concepts through scientific activities.

The combination of inquiry learning model and the REACT learning model also has the potential to empower metacognitive skills and critical thinking skills to improve the students' process skills, because the combination of these models has complementary learning syntax to support the learning success. At the stage of inquiry learning, the students are required to empower their critical thinking skills through the activities of formulating problems from the phenomenon encountered, conducting investigations, analyzing and communicating the results of the investigation (Alberta, 2004; Sutama, et al., 2014), while REACT learning requires the students to be involved in the learning activites to find and solve problems in groups. Through this study group, the empowerment of the students' metacognitive skills will increase (Corebima, 2009). This learning is not only studying concepts in schools, but also studying the knowledge that the students have gained, and applying it in the real world contexts.

The purpose of this study was to determine the correlation between metacognitive skills and critical thinking skills toward the process skills of Malang Senior High School students in biology. Also uncovered in this study would be the total effective contribution of metacognitive skills and critical thinking skills toward the process skills, as well as the partial effective contributions of the two predictors respectively.

2. Method

The design of this research was a descriptive correlation study. In this research, metacognitive skills and critical thinking skills were used as the predictors, while process skills were used as the criterion. The population of this study was all the students of class X Senior High Schools in Malang in the second semester of the 2017/2018 academic year. The samples used in this research

were the students of science 1 class X of Senior High School 8 Malang with the total number of 30 students, science 2 class X of Senior High School 8 Malang with the total number of 28 students and science 3 class X of Senior High School 5 Malang with the total number of 34 students. The sampling technique used was a simple random sampling technique.

This research was supported by the learning materials of the inquiry learning model, which are included the syllabus, lesson plan (RPP), Student Worksheet (LKS), test items for the pretest and posttest with the total number of the 26 items. The instruments used in this research were metacognitive skill rubric, critical thinking skill rubric, and process skill rubric. The data were analyzed by using multiple regression analysis supported by software SPSS for Windows 23 and performed at a significance level of 5%.

3. Results

3.1. Hypothesis Testing of the Inquiry Learning Model

Hypothesis testing in this study used multiple linear regression. The results of ANOVA on the correlation between metacognitive skills and critical thinking skills toward the students' process skills are presented in Table 1.

Table 1
Summary of ANOVA Test on the Correlation between metacognitive Skills and critical Thinking Skills toward the Students' Process Skills

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	926,250	2	463,125	22,874	,000[b]
	Residual	506,166	25	20,247		
	Total	1432,416	27			

The results of ANOVA in Table 3.1 show that the F value is 22.874 and the *p-value* = 0.000. Thus, it can be concluded that metacognitive skills and critical thinking skills have a significant correlation toward the students' process skills through the implementation of inquiry learning model. The summary of the results of the multiple linear regression on the correlation between metacognitive skills and critical thinking skills toward the students' process skills can be seen in Table 2.

Table 2
Results of the Multiple Linear Regression Test on the Correlation between Metacognitive Skills and Critical Thinking Skills toward the Students' Process Skills

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,804[a]	,647	,618	4,49963

The results of the regession test in Table 4.3 show that the correlation coefficient (R) is 0.804 with a reliability value (R^2) of 0,647. This shows that metacognitive skills and critical thinking skills have a contribution of 64.7% toward the students' process skills, while the remaining 35.3% is influenced by other factors in addition to metacognitive skills and critical thinking skills. The relative contribution and effective contribution of metacognitive skills and critical thinking skills toward the students' process skills can be seen in Table 3.

Table 3
Relative Contribution and Effective Contribution of Metacognitive Skills and Critical Thinking Skills toward the Students' Process Skills

Variable	RC(%)	EC(%)
X1 (Metacognitive skills)	17,16	11,1
X2 (Critical thinking skills)	82,84	53,6
Total	100	64,7

Description→ RC: relative contribution; EC: effective contribution.

Table 3 shows that the metacognitive skills have a relative contribution as much as 17.16% toward the students' process skills, and critical thinking skills have a relative contribution as much as 82.84% toward the students' process skills. Thus, the total relative contribution is 100%. Additionally, metacognitive skills and critical thinking skills have contributions toward the students' process skills as much as 11,1% and 53,6% respectively. Thus, the total effective contribution is 64.7%.

The results of the regression equation analysis of the correlation between metacognitive skills and critical thinking skills toward the students' process skills are presented in Table 4.

Table 4
Multiple Regression Equation Coefficient Analysis of Metacognitive Skills and Critical Thinking Skills toward the Students' Process Skills

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	7,658	8,693		,881	,387
	MetaINQ	,148	,392	,143	,377	,709
	CriticalINQ	,753	,427	,667	1,762	,090

Table shows that the regression line equation of the correlation between metacognitive skills and critical thingking skills toward the students' process skills is $Y = 0{,}148X_1 + 0{,}753X_2 + 7{,}658$.

3.2. Hypothesis Testing of the REACT Learning Model

The results of ANOVA test on the correlation between metacognitive skills and critical thinking skills toward the students' science process skills can be seen in Table 4.5. The results of ANOVA in Table 5 show that the F value is 56.574 and the *p-value* = 0.000. Thus, it can be concluded that metacognitive skills and critical thinking skills have a significant correlation with students' process skills through the implementation of REACT learning model.

Table 5
The Results of Anova of the Correlation between Metacognitive Skills and Critical Thinking Skills toward the Students' Process Skills

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1774,634	2	887,317	56,574	,000[b]
	Residual	407,792	26	15,684		
	Total	2182,426	28			

The summary of the regression test on the correlation between metacognitive skills and critical thinking skills toward the students' process skills can be seen in Table 6. The results of the regression test in Table 6 show that the correlation coefficient (R) is 0.902 with a reliability value (R^2) 0.813. This suggests that metacognitive skills and critical thinking skills have a contribution of 81.3% toward the students' process skills, while the remaining 18.7% is influenced by the other factors in addition to metacognitive skills and critical thinking skills.

Table 6
The Results of linier Regression Test Results of the Correlation between Metacognitive Skills and Critical Thinking Skills toward the Students' Process Skills

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,902[a]	,813	,799	3,96034

The relative contribution and the effective contribution of metacognitive skills and critical thinking skills toward the students' process skills can be seen in Table 7. The data in Table 7 show

that metacognitive skills have a relative contribution as much as 97.19% toward the students' process skills, and the critical thinking skills have a contribution as much as 2.81% toward the students' process skills. Meanwhile, the effective contribution of metacognitive skills toward the students' process skills is as much as 79.2%, and the effective contribution of critical thinking skills toward the students' process skills is as much as 2.28%. Thus, the total effective contribution is 81.48%.

Table 7
Relative Contribution and effective Contributiom of Metacognitive Skills and Critical Thinking Skills toward the Students' Process Skills

Variable	RC(%)	EC(%)
X1 (Metacognitive skills)	97,19	79,02
X2 (Critical thinking skills)	2,81	2,28
Total	100	81,3

The results of the regression analysis to determine the correlation between metacognitive skills and critical thinking skills toward the students' process skills are presented in Table 8. Table 8 shows that the regression equation of the correlation between metacognitive skills and critical thinking skills towards the students' process skills through the implementation of REACT learning model is $Y = 1{,}039X_1 - 0{,}029X_2 + 0{,}662$.

Table 8
The Results of the Linear Regression Equations Coefficient of Metacognitive Skills and Critical Thinking Skills toward the Students' Process Skills

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	,662	6,235		,106	,916
	MetaREACT	1,039	,774	,928	1,342	,191
	CriticalREACT	-,029	,768	-,027	-,038	,970

3.3. Hypothesis Testing related to the INREACT Learning Model

The results of ANOVA test on the correlation between metacognitive skills and critical thinking skills toward the students' process skills can be seen in Table 9. The results of ANOVA test in Table 9 show that the F value is 43.525 and the *p-value* = 0.000. Thus, it can be concluded that metacognitive skills and critical thinking skills have a significant correlation with students' process skills through the implementation of the INREACT learning model.

Table 9
The Results of the Anova Test on the Correlation between Metacognitive Skills and Critical Thinking Skills toward the Students' Process Skills

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2445,875	2	1222,938	43,525	,000[b]
	Residual	927,204	33	28,097		
	Total	3373,079	35			

The results of regression analysis on the correlation between metacognitive skills and critical thinking skills toward the students' process skills can be seen in the Table 10.

Table 10
The Results of Linear Regression of the Correlation between Metacognitive Skills and Critical Thinking Skills toward the Students' Process Skills

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,852[a]	,725	,708	5,30067

The results of regression analysis in Table 10 show that the correlation coefficient (R) is 0.852 with a reliability value (R^2) 0.725. This suggests that metacognitive skills and critical thinking skills have a contribution of 72.5% toward the students' process skills, while the remaining 27.5% is influenced by other factors in addition to metacognitive skills and critical thinking skills.

The relative contribution and the effective contribution of metacognitive skills and critical thinking skills toward the students' process skills can be seen in Table 11. The data in Table 11 show that metacognitive skills have a relative contrirbution of 66.73% toward the students' process skills, and critical thinking skills have a relative contribution of 33.27% toward the students' process skills. Meanwhile, the effective contribution of metacognitive skills toward the students' process skills is 48.38%, and the effective contribution of critical thinking skills toward the students' process skills is 24.12%. Thus, the total effective contribution is 72.5%.

Table 11
The relative Contribution and the effective Contribution of Metacognitive Skills and Critical Thinking Skills toward the Students' Process Skills

Variable	RC(%)	EC(%)
X1 (Metacognitive skills)	66,73	48,38
X2 (Critical thinking skills)	33,27	24,12
Total	100	72,5

The results of the regression equation analysis to determine the regression equation of the correlation between metacognitive skills and critical thinking skills toward the students' process skills are presented in Table 12. Table 12 shows that the regression line equation of the correlation between metacognitive skills and critical thinking skills toward the students' process skills through the implementation of INREACT learning model is $Y = 2{,}322X_1 - 1{,}172X_2 - 9{,}662$.

Table 12
The linear Regression Equations Coefficient of Metacognitive Skills and Critical Thinking Skills toward the Students' Process Skills

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-9,088	9,279		-,979	,335
	MetaComb	2,322	1,095	1,712	2,120	,042
	CriticalComb	-1,172	1,086	-,871	-1,079	,288

4. Discussion

The results of the study on the three learning models show that there is a positive correlation between metacognitive skills and critical thinking skills toward the students' process skills. In addition, this research also shows some differences in the effective contribution which is uncovered at each learning model implemented. The effective contributions of metacognitive skills and critical thinking skills toward the students' process skills through the implementation of the inquiry, REACT and INREACT learning models are 64,7%, 81,3% and 72.5% respectively. The data show that the effective contribution through REACT learning model is higher than that through inquiry and INREACT learning models. This means that the learning model used is a

main aspect that causes the high contribution of metacognitive skills and critical thinking skills toward the students' process skills. In accordance with Karpicke (2009), the selection of learning models will have an effect on the learning processes. In this case, it has an effect on the students' knowledge and process skills.

In inquiry learning, the effective contribution of critical thinking skills toward the students' process skills (53,6%) is higher than that of metacognitive skills (11,1%). On the other hand in REACT learning as well as in INREACT learning, the effective contribution of critical thinking skills is lower than that of metacognitive skills. In REACT learning, the effective contribution of critical thinking skills is only 2,28%, but that of metacognitive skills is up to 79,02%; in INREACT learning, the effective contribution of critical thinking skills is 24,12%, and that of metacognitive skills is 48,38%. Therefore it is seen clearly that related to process skills, inquiry learning has greater potency to empower students' critical thinking than their metacognition. Furthermore REACT and INREACT learnings have greater potency to empower students metacognition than their critical thinking.

In addition, Slameto (2010) said that in learning, the change of the students' knowledge would have an effect on the change in their skills and attitudes. Science process skills can be trained if scientific activity occurs, and the students are able to perform higher order thinking in learning (Masek & Sulaiman, 2011). Metacognitive skills and critical thinking skills have a positive correlation with process skills because the students' science process skills will be maximal if their metacognitive skills, as the control of the *high order* thinking, and the critical thinking skills are optimally developed, which is considered essential in order to encourage the students to be active in the learning activities (Corebima, 2012; Livingston, 1997; Tan, 2004).

The results of the study are in line with previous research. For example, the research conducted by Pratiwi *et al.,* (2016) reported that there was a correlation between metacognitive skills and process skills through the implementaiton of *Think Pair Share* learning model. Safarati (2017) stated that there was an interaction between the students' critical thinking skills and their process skills through the implementation of inquiry learning model. A similar research conducted by Duran and Dikme (2016) reported that there was a significant correlation between students' critical thinking skills and their process skills through the implementation of inquiry learning strategy.

As what has been stated by some experts in Corebima (2006) that metacognition plays an essential factor in controlling cognitive activities of a person which includes understanding, communication, attention, retention *(memory),* and problem solving in learning (Eggen & Kauchak, 1996; Howard, 2004). Metacognitive skills need to be empowered in learning because, with metacognitive skills, students can organize information and behavior, and they can complete the learning activities more easily (Coutinho, 2007; Downing, 2009).

Metacognitive skills are not formed by itself, but it need to be continuously empowered using the appropriate learning techniques and learning approaches. One of the appropriate approaches to empower the students' metacognitive skills is the students' science process skills. In the process, process skills requires the students to directly interact with learning resources. Thus, with this activity, the students are trained to develop their metacognitive skills in learning. The direct experience created by these process skills provides a more meaningful learning experience for the students to develop their knowledge expressed in their metacognitive skills to solve problems and formulate the right results (Hirca, 2013; Ozgelen, 2012; Pardhan, 2000; Rustaman, 2005).

Critical thinking skills require a person to be responsible for and capable of making a decision about a concept that is believed and applied. Through critical thinking skills, the students are able to ask questions, to be creative in collecting and sorting accurate information, so that they can express their opinions and summarize a conclusion according to the information already obtained (Schafersman, 1991). Similarly, Elder & Paul (2007), state that a person who had critical thinking skills had the ability to ask important questions and then to formulate them. They can collect information, assess and to interpret abstract ideas, give appropriate conclusions and solutions and

then to test them, accept all ideas, judgments and opinions of other people, and effectively communicate with other people to solve problems.

Critical thinking skills have a correlation with the students' process skills. The learning process should contain some learning activities that challenge students 'critical thinking skills and improve students' process skills in solving problems, finding and analyzing to establish an appropriate concept. The process skills which are empowered in learning emphasize on the students' critical thinking skills (Trianto, 2010). Science process skills are the skills that involve a person's intellectual skills. It means that learning should empower students' critical thinking skills as a manifestation of their intellectual skills to assess information (Duron, et al., 2006; Rustaman, 2003).

Based on the results of this research, the knowledge obtained by the students to achieve metacognitive skills and critical thinking skills which have an effect on the improved process skills cannot be separated from the implemented learning strategy (Mayers, Washburn, & Dyer, 2004). The learning model which has the potential to empower the students' process skills and knowledge is the inquiry learning model. Inquiry learning is a learning activity which emphasizes on the critical and analytical thinking process to find answers to a problem that has been formulated (Sanjaya, 2010). The empowerment of process skills requires the students to be actively involved with concepts and principles to gain experience in experimentation (Trianto, 2009). Learning to discover is a way to obtain the best results.

Inquiry learning can increase science concept acquisition and critical thinking skills because students become more skilled in obtaining and analyzing information. The indicators developed in inquiry learning are formulating problems, formulating hypotheses, collecting data, analyzing data, and making conclusions. Inquiry learning is designed with scientific process to stimulate students and to foster scientific attitudes through scientific activities, so that students will better understand process skills (Wening, 2007). The students' process skills will not develop when the learning process does not accommodate scientific activities that can trigger the growth of their scientific attitudes and empower their process skills. In inquiry learning, the students use all mental processes to discover concepts, which are then channeled through scientific activities, in order to develop the students' process skills (Karamustafaoglu, 2011).

In addition to the inquiry learning model, another learning model which has the potential to determine the correlation between metacognitive skills and critical thinking skills toward the students' process skills, and has the highest effective contribution in this research is the REACT learning model. REACT learning is a contextual learning model that emphasizes knowledge and meaningful learning. Contextual learning is learning that triggers students' ability to connect the learning material with the real world situation, and to connect their knowledge with the application of the concepts in their daily lives (Trianto, 2007). Through REACT learning model, the students are able to process new information or knowledge according to their minds (memory, experience, and response) (Texas Collaborative for Teaching Excelence, 2007).

The REACT contextual learning model has five important learning components, which include (1) *Relating* or learning in the context of linking, (2) *Experiencing* or learning in the context of experiencing, (3) *Applying* or learning in the context of applying, (4) *Cooperating* or learning in the contect of group work and (5) *Transferring* or learning in the context of knowledge transfer (Texas Collaborative for Teaching Excellence, 2007). This learning model is considered to be very effectivene in developing students' knowledge through their metacognitive skills and critical thinking skills that will have an effect on the improvement of their process skills.

Another learning model which has high contribution in this research is INREACT learning model. This learning model is a combination of inquiry learning model and REACT learning model which is very effective in empowering students' metacognitive skills and critical thinking skills in order to improve their process skills. Both of these learning models are complementary. The Inquiry learning model is designed to directly involve students in the scientific process and to build a more meaningful learning experience; while REACT learning is one of the learning models that requires students' to be active and have good cooperation. One of the stages of excellence in

this REACT learning model is to facilitate the students to discuss and to work together in groups, so that the misconceptions of a student can be refined by other group members to get the right concepts (Crawford, 2001).

5. Conclusion

There is a correlation between metacognitive skills and critical thinking skills toward the process skills through the implementation of inquiry learning model, REACT learning model and INREACT learning model of senior high school students in Malang. The greatest effective contribution of metakognitive skills and critical thinking skills toward the process skills is found at the implementation of the REACT learning model.

In the inquiry learning model, the contribution of metacognitive skills and critical thinking skills toward the students' process skills is 64,7% with the correlation coefficient as much as 0,804. Metacognitive skills and critical thinking skills have effective contributions of 11,1% and 53,6% toward respectively the students' process skills with the regression equation $Y = 0,148X_1 + 0,753X_2 + 7,658$.

In the REACT learning model, the contribution of metacognitive skills and critical thinking skills toward the students' process skills is 81,3% with the correlation coefficient as much as 0,902. Metacognitive skills and critical thinking skills have effective contributions of 79,2% and 2,28% respectively toward the students' process skills with the regression equation $Y = 1,039X_1 - 0,029X_2 + 0,662$.

In the INREACT learning model, the contribution of metacognitive skills and critical thinking skills toward the students' process skills is 72.5% with the correlation coefficient as much as 0.852. Metacognitive skills and critical thinking skills have effective contributions of 48.38% and 24,12% respectively toward the students' process skills with the regression equation $Y = 2,322X_1 – 1,172X_2 - 9,662$.

5.1. Recommendation

Future researchers are expected to conduct additional studies related to the correlation between metacognitive skills and critical thinking skillls toward process skills or other variables using Inquiry, REACT, INREACT or other learning models, which are expected to improve students' metacognitive skills and critical thinking skills.

The results of this research study can become a guide for teachers to develop learning models that have the qualities to empower students' metacognitive skills, critical thinking skills, and process skills.

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