



# **Study on the correlation between metacognitive skills and concept gaining of biology at several learning models**

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## **Contents**

- [Abstract](#)
  - [Introduction](#)
  - [Method](#)
  - [Results](#)
  - [Discussion](#)
  - [Conclusion](#)
  - [References](#)
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## **Abstract**

Many researches on the correlation between metacognitive skills and concept gaining have been widely carried out based on a particular learning model. It was uncovered that there was a significant positive correlation between metacognitive skills and concept gaining. Is it always so, related to one or several learning models? This survey study is conducted to reveal the general idea of the correlation between metacognitive skills and concept gaining based on 26 learnings. The data of metacognitive skills and concept gaining were analyzed using simple linear regression. There was a significant correlation between metacognitive skills and



concept gaining at 21 out of the 26 learnings. Thus at one or several learning models there will always be a positive linear correlation between metacognitive skills and concept gaining. Future researches are expected to emphasize on the contribution amount of the metacognitive skills to the concept gaining. The regression equation of the correlation between metacognitive skills and concept gaining of low academic ability students undergoing the cooperative script learning, was proven to have the highest contribution, as much as 87.9%. A different contribution was observed in the Cooperative script learning model implemented in the class of high academic ability students. There was a lower contribution, which was only as much as 36.1%. A similar phenomenon was observed too in relation with the other learning models, such as Jigsaw and TPS learning models. It is believed that it is caused by certain factors in the learning process making the empowerment of metacognitive skills in that particular classroom to be optimal. It is believed that the fact is related to the students' characters, both the high academic ability students and low academic ability students. If there is a particular school or class having many low-academic ability students, the teachers are expected to implement one of the learning models in the class because the model has been proven to have potential in improving the metacognitive skills of low academic ability students, so as to have an effect on the improvement of students' concept gaining.

**Keywords:** Concept gaining, learning model, metacognition, metacognitive skills

## Introduction

The empowerment of students' skill is essential to be done. One of the students' skills that can be empowered is their metacognitive skills. A person should be provided with metacognitive skills in order to improve his thinking ability. Metacognition is defined as the knowledge of cognition and control of cognition (Flavell, 1979). In some studies metacognitive skill is often used for cognitive psychology research and psychology education. However, not only in that field, metacognitive skill is also important in the learning field. The empowerment of metacognitive skills of learners will be able to give impacts on their cognition processes.

Metacognitive skill is often associated with a person's think ability. Several studies investigating about a person's cognitive skill suggested that there was a correlation



between metacognition and metamemory, critical thinking and even motivation (Lai, 2011). Metacognitive skills also are needed by students when they are dealing with challenging tasks so that the students can face these challenges. When students face these tasks, three meta-cognitive skills (planning, monitoring, evaluating) are very helpful. Students usually do not realize that they have been planning, monitoring, and evaluating their learning (Woolfolk, 2010).

Anyone having thinking ability well-trained will be able to solve a problem. Someone who has been accustomed to using his thinking skills well will be able to find the right solution to solve a problem. It is often associated with a person's concept gaining of what he is learning. Veenman, Wilhelm, and Beishuizen (2004) stated that metacognition could give significant contribution to learning especially those related to intellectual ability. Furthermore, it was also explained that the empowerment of a person's metacognitive skills can be related with his her cognition.

Metacognitive skill also can improve a person's academic skill based on his/her age and cognitive ability. It can also empower a person's ability to read a reading material, to write, as well as ability related to math skills, problem solving, and retention (Dignath, Buttner & Langfeldt, 2008). Slavin (2013) stated that metacognitive skills of a person will be able to help him/her in learning and will even help to know how he/she can learn best. This statement is in line with Schraw's statement (1998) saying that one purpose of metacognitive skills empowerment is in order the students understand how a certain task should be carried out.

There have been many researches investigating metacognitive skills and concept gaining. One type of researches that has been conducted is the correlation regression between metacognitive skills and concept gaining. The researches have been carried out at the level of elementary schools (Zen, 2010; Basith, 2011), junior high schools (Siswati & Corebima, 2016) and senior high schools (Arifin, 2013; Ardila, 2013, and Fauziyah, 2013). Almost all of the researches showed that there were a significant positive correlation between metacognitive skills and concept gaining. Erfani and Azad (2013) conducted a research on the correlation between StateMeta-Cognition and creativity with students' academic achievement.

The correlation between students' metacognitive skills and learning results in science subjects had previously been revealed by (Singh, 2012). Similarly Olorundare (2011) showed that there was a strong correlation between the students'



self-efficacy and their learning results. Some research findings indicate that a person's metacognitive ability is correlated with his academic ability. Perfect and Schwartz (2004) stated that metacognition had a positive correlation with the students' learning and understanding. Therefore, the students who are aware of their metacognitive skills will be able to improve their learning and academic ability.

Those researches were carried out on the basis of one particular model. The learning models used in these researches were the Problem Based Learning (Zen, 2010), Jigsaw (Basith, 2011), Reciprocal Teaching (Arifin, 2013), Think Pair Share (Siswati & Corebima, 2016), thinking Empowerment by Questioning (Ardila, 2013). Another research by Chikmiyah and Sugiarto (2012) showed that there was a significant and strong correlation between students' metacognitive knowledge and their learning results in the implementation of TPS learning strategy. Several research findings have shown that there was a correlation between metacognitive skills and concept gaining/learning results, but is it always so in one learning model or several learning models? Further researches are still needed to obtain the answers related to this issue.

One way that can be done is by conducting a survey research. The research survey is conducted by collecting a number of data to be re-analyzed and compared with the previous research result. By knowing the correlation tendency uncovered in the results of this study, a general conclusion about the correlation between metacognitive skills and concept gaining can be drawn. After a general description of the correlation between metacognitive skills and concept understanding on a learning model or several learning models is revealed, it can be explained what things to be done by further similar researches. In this case, for example, it can be concluded that from the many previous researches, that there is a correlation between metacognitive skills and concept gaining, is it still necessary to conduct a research to uncover the correlation between metacognitive skills and concept gaining; or not necessary. If it is still necessary to conduct a research investigating whether or not there is a correlation between metacognitive skills and concept gaining, should it be done repeatedly only to uncover the correlation, or directing the research of the correlation to the other direction. This research is expected to give an answer to it.



## Method

This study was a survey research. The data were taken from the previous researches. Some of those researches were conducted by Sarumaha (2009), Siswati (2012), Efendi (2012), Kusumaningtias (2013), Siswati (2014), Lukitasari (2014), and Priantari (2014). The total samples were 735 students, divided into 13 learnings. The learning models used in this research were Numbered Heads Together (NHT), NHT integrated with metacognition, Problem Based Learning (PBL), PBL integrated with NHT, Reciprocal Teaching (RT), Think Pair Share (TPS), RT integrated with TPS, Jigsaw, Cooperative Script (CS), Thinking Empowerment by Questioning (TEQ), and TEQ Integrated with TPS (TEQ + TPS), E-Portfolio based on Lesson Study, and Reading Questioning and Answering (RQA) integrated with TPS. The collected data were in the form of students' metacognitive skills and concept understanding. This research used simple linear regression analysis, after the normality of the data was performed by using One-Sample Kolmogorov-Smirnov Test and the homogeneity of the data was performed by using Levene's Test. Data were analyzed by using SPSS software version 16 for Windows and performed at the 5% significance level.

## Results

The results of the simple linear regression test analyzed can be seen in Table I.

**Table I.** Summary of Anova Test on the Correlation between metacognitive Skills and Biology Concept Gaining

| Anova | 1      | 2      | 3      | 4      | 5     | 6      | 7      | 8      | 9      |
|-------|--------|--------|--------|--------|-------|--------|--------|--------|--------|
| F     | 67.243 | 16,277 | 16.361 | 43.107 | 5.350 | 80.008 | 66.776 | 58.324 | 71.661 |
| Sig.  | 0.000  | 0.002  | 0.000  | 0.000  | 0.049 | 0.000  | 0.000  | 0.000  | 0.000  |
| R2    | 70.6%  | 57.6%  | 36.1%  | 59,8%  | 40.1% | 74.8%  | 66.9%  | 75.4%  | 75.7%  |

| Anova | 10      | 11     | 12    | 13     | 14     | 15    | 16    | 17    | 18     |
|-------|---------|--------|-------|--------|--------|-------|-------|-------|--------|
| F     | 202.801 | 23.621 | 0,473 | 88.365 | 10.876 | 1.127 | 0.897 | 2.105 | 11.668 |
| Sig.  | 0.000   | 0.000  | 0,499 | 0.000  | 0.004  | 0,298 | 0,352 | 0,157 | 0.002  |



|    |       |       |      |       |       |      |      |      |       |
|----|-------|-------|------|-------|-------|------|------|------|-------|
| R2 | 87.9% | 45.8% | 2.1% | 83.1% | 37.7% | 4.3% | 3.1% | 6.2% | 29.4% |
|----|-------|-------|------|-------|-------|------|------|------|-------|

| Anova | 19     | 20     | 21     | 22     | 23     | 24     | 25    | 26    |
|-------|--------|--------|--------|--------|--------|--------|-------|-------|
| F     | 39.566 | 23.933 | 27.076 | 19.959 | 16.737 | 11.166 | 4.008 | 6.021 |
| Sig.  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.002  | 0.054 | 0.019 |
| R2    | 58.6%  | 46.1%  | 49.2%  | 64.5%  | 37.4%  | 21.4%  | 11.8% | 37.4% |

Note:

1. Jigsaw learning model in senior high school of high academic ability
2. TPS learning model in senior high school of high academic ability
3. CS learning model in senior high school of high academic ability
4. RT learning model in senior high school of high academic ability
5. PBL learning model in senior high school of high academic ability
6. TEQ learning model in senior high school of high academic ability
7. TEQ + TPS learning model in senior high school of high academic ability
8. Jigsaw learning model in senior high school of low academic ability
9. TPS learning model in senior high school of low academic ability
10. CS learning model in senior high school of low academic ability
11. RT learning model in senior high school of low academic ability
12. PBL learning model in senior high school of low academic ability
13. TEQ learning model in senior high school of low academic ability
14. TEQ + TPS learning model in senior high school of low academic ability
15. E-Portfolio based on lesson study learning in university
16. RQA + TPS learning model in university
17. PBL + NHT learning model in senior high school
18. RT + TPS learning model in senior high school of high academic ability
19. RT learning model in senior high school of high academic ability
20. TPS learning model in senior high school of high academic ability
21. RT + TPS learning model in senior high school of low academic ability
22. RT learning model in senior high school of low academic ability
23. TPS learning model in senior high school of low academic ability
24. NHT learning model in senior high school
25. NHT + Meta learning model in senior high school
26. NHT learning model in senior high school



The results of the correlation and regression analysis showed that the significance value uncovered at 21 learnings was smaller than 0.05 ( $p < 0.05$ ). This shows that there is a correlation between metacognitive skills and biology concept gaining at the implementation of the 21 learnings. However the significance value uncovered at 5 learning was bigger than 0.05. This fact shows that there is not any correlation between metacognitive skills and concept gaining at the implementation of the 5 learnings. These analysis results were accompanied by the value of the contribution of each learning model (as indicated by the value of  $R^2$ ).

## Discussion

The results of the data analysis showed that almost all of the learning models showed a significant positive correlation between students' metacognitive skills and their concept gaining. This is in line with the previous researches conducted by Zen (2010), Basith (2011), Arifin (2013), Fauziyah (2013), Ardila (2013), Siswati (2014), and Siswati & Corebima (2016). Some previous researches also have revealed that metacognitive skills have a significant effect on students' achievement (Zulkiply et al., 2008). Metacognitive skills can help a person to transfer what he has learned in a new context and even in new assignments. Some researchers believe that someone metacognition is associated with intelligence (Kayashima, Inaba & Mizoguchi, 2004). Magno (2010) described the correlation between metacognitive skills and critical thinking skills. Similarly, Ku and Ho (2010) also investigated the correlation between metacognitive skills and thinking skills. In addition to train a person's thinking ability, metacognitive skill is also proven to be able to train problem-solving skill (Hacker & Dunlosky, 2003).

In the previous studies, it was explained also that metacognitive skill involved planning, evaluating and monitoring someone's learning (Vrieling, Bastiaens, & Stijnen, 2012). Thus, someone whose metacognitive skill has been well trained will learn more easily, because he knows how to learn and to evaluate his own learning. Senemoglu (2012) stated that those who had high metacognitive skills would be able to enhance his confidence to succeed in something, even he would be aware if he made a mistake.

Eggen and Kauchak (1996) also explained that metacognitive skills could help students to regulate their learning process by themselves and became independent learners in order to improve their learning results significantly. Metacognitive skills



also play a role in many types of cognitive activities including comprehension, communication, attention, memory, and problem solving (Howard, 2004). Therefore, it is believed that continuous empowerment of metacognitive skills will be able to improve a person's learning results.

Not only associated with thinking ability, metacognitive skill is also associated with the retention of a person. Muhiddin (2012) investigating the correlation between metacognition and retention showed that they had a significant correlation. Moreover, Curwen et al. (2010) also revealed that the students' ability to think by using their metacognition would be able to distinguish between high achieving students and low achieving students. Louca (2008) explained that metacognition was not just about thinking how to think but it also included how people acquired knowledge and process information. It is implied that metacognitive skills will have an effect on a person's cognition, and particularly how they process the information obtained.

The results of the research show that from all the 26 learnings analyzed related to the correlation between metacognitive skills and concept gaining, 5 learnings were proven to have no correlation. This might be because there were some internal or external factors that caused the results different from the others. Those factors occurred during the learning process, so that it affected the results of the research. Basically, based on this research it is believed that the correlation between metacognitive skills and concept gaining will always be the same in one learning model or several learning models.

The results that have been revealed in this research imply that the future researches investigating the correlation between metacognitive skills and concept gaining should not aim for determining whether or not there is a correlation between the two variables. The correlation between metacognitive skills and concept gaining will always be the same, both in one learning model or several learning models. Therefore, future researches should aim to reveal the contribution amount of metacognitive skills toward concept gaining.

Based on the results of this study, the largest contribution of metacognitive skills on concept gaining of the students is found at Cooperative Script learning model implemented at the low academic ability student class; the highest contribution is as much as 87.9%. On the other hand the contribution found at CS learning model implemented at high academic ability student class, is much lower than that of



implemented at the low academic ability student class; the much lower contribution is only as much as 36.1%. The same phenomenon is also found in relation with the Jigsaw and TPS learning models. The contribution found at Jigsaw learning model implemented at low academic ability student class is as much as 75.4%. It is higher than the contribution found at Jigsaw learning model implemented at high academic ability student class, which is as much as 70.6%. Similarly, the contribution found at TPS learning model implemented at the low academic ability student class is 75.7%. It is also higher than the contribution found at TPS learning model implemented at the high academic ability student class, which is only as much as 57.6%.

Based on the analysis result, metacognitive skill is proven to have higher contribution in low academic ability students than that in high academic ability students. This fact may be related to the students' characteristics, both the high-academic ability students and the low-academic ability students. The characteristics are for example, the high academic ability students tend to have high capability in grasping the learning material, so that the instructional model used by the teacher does not have a significant effect on the improvement of the students' metacognitive skills. On the other hand, the low academic ability students, who basically have low academic ability, are very helpful with the learning model used by the teachers. This condition has an effect on the improvement of students' metacognitive skills. Other findings that can be revealed in this research are that the learning models used in this research have been proven to help the low academic ability students. In addition, if in a particular school or in a particular class there are many low academic-ability students, these learning models are very necessary to be implemented, as they have been proven to have big potential in empowering the metacognitive skills of low-academic ability students.

The importance of revealing such factors is related to the teachers' success in empowering students' metacognitive skills as well as students' concept gaining simultaneously. The teachers who wish to optimally empower students' metacognitive skills and concept gaining should implement particular learning models that have been previously reported to be able to empower students' various skills, as well as pay attention to the factors mentioned so that it can obtain maximal results related to the two targets. When teachers teach using specific learning model and pay attention to these factors, it can be ensured that, when a simple linear regression test was performed, the contribution of metacognitive skill to concept gaining will be consistently high. It is believed that the higher the students'



metacognitive skill is, the higher the students' concept gaining is, and vice versa. If the concept gaining is measured, and if it is proven that the students' concept gaining is high, it means that the students' metacognitive skill is also high, because metacognitive skill has a positive correlation with concept gaining.

## Conclusion

The results of this research reveal that the correlation between metacognitive skills and concept gaining of one learning model or several learning models will always be the same (e.g. producing a linear correlation). If it was found that there was not any significant correlation between metacognitive skill variable and concept gaining variable, it should be related with a particular cause in that condition which caused such results. Some factors which possibly causes the correlation to be not significant is, for example, the data distribution is too narrow, the sample used too small, measurement errors, and the other situations that may occur during the learning process (e.g. lack of conducive learning environment). The implication for future researches investigating the correlation between metacognitive skills and concept gaining is that those researches should aim to reveal the contribution amount of the metacognitive skills to the concept gaining, not aim to determine whether or not there is a correlation between the two variables. The research investigating the contribution of the predictor to the criterium is believed to be necessary because the amount of contribution related will vary caused by various factors.

One of the factors that can be revealed, for example, is related to the students' characteristics (high academic ability and low academic ability). Another finding of this research is that the learning models examined in this research have been proven to improve the metacognitive skills of low academic ability students, so as to have an effect on the students' concept gaining. If a particular school or class has many low academic ability students, it is expected that teachers implement the learning models which have been proven to have potential in empowering the students' metacognitive skills.

Further study which aims at revealing the ideal factors in a particular learning model is necessary, so that the empowerment of students' metacognitive skill can be more optimal; and so students' concept gaining can be more optimal too. Teachers who pay attention to these factors when implementing the learning models that has been proven be potential are believed to provide consistently high results.



## Suggestion

In order to uncover a more general picture of the correlation between metacognitive skills and concept gaining, further researches need to be conducted. The research can be carried out using a bigger number of samples, as well as can be conducted under different conditions, not only based on one learning model but also based on several learning models. Furthermore the researches can be conducted based on, for example, education level, grade level, academic ability, gender or ethnicity.

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