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The Correlation of Metacognition with Critical Thinking Skills of Grade XI Students on Human Excretion System Concept

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Dea Diella[1], Ryan Adriansyah[2]

[1,2]Department of Biology Education, Faculty of Teacher Training and Education,
Universitas Siliwangi, Tasikmalaya, Indonesia
Email: *deadiella@unsil.ac.id

Abstract

The aims of this study is to reveal metacognition and critical thinking skill of students grade XI, and also the correlation between metacognition with crititical thinking skill on human excretion system. The participants of this study consist of 100 students from grade XI of five different high schools in Tasikmalaya. Correlational method was used in this study. Instruments which used to obtain the data consist of metacognition test and critical thinking test. The students' metacognition was captured with the essay item related to the human excretion system concept. The multiple choice-reason item and essay item was used to capture the critical thinking skills. The results showed that students' score at metacognition and critical thinking have a low average. The results also proved that metacognition has a positive correlation and moderately strong with critical thinking skills.

Keywords: Metacognition, Critical Thinking Skills, Human Excretion System

INTRODUCTION

Students generally do not develop effective learning strategies (Matlin, 1994). The learning strategy involves knowledge of how to learn in accordance with the conditions or characteristics of the material, review the understandings diligently, knowing the method of recording information for easy comprehension, and determining learning goals. Most of them succeed in school through memorizing information only for exams. Memorizing makes the learning process meaningless because the meaningful learning should involve the cognitive processes from the start of information received and associated with existing information (Ausubel in Dahar 1996). Ausubel also stated that the memorizing study happens if students do not assimilate new knowledge to relevant concepts already existing in their cognitive structure. In addition, memorizing also does not require students to develop higher-order thinking skills. Higher-order thinking builds on simple skills such as discrimination, simple application and analysis, and cognitive strategies to link initial knowledge with new material. Higher order thinking can include critical thinking, logical, reflective, metacognitive and creative (King et al, 1998).

Planning, monitoring, and evaluating are at the core of metacognition (Flavel, 1979). Metacognition is a person's knowledge of their mind. Schraw and Dennison (in Lai, 2011) suggests the metacognition includes knowledge of cognition and regulation of cognition. Knowledge of cognition consists of declarative knowledge, procedural knowledge and conditional knowledge. While the regulation of cognition consists of planning, information management strategies, comprehension monitoring, debugging strategies, and evaluation.

Critical thinking skills are related to metacognition. A person with good critical thinking skills has better metacognitive activity especially in aspects of planning and evaluating strategies (Ku & Ho, 2010). Critical thinking skills are a crucial skill for a person to be able to compete in a globalized world. Such skills can be developed and enhanced by various learning methods, for example inquiry-based learning, problem solving, case studies, lab activities and essay writing (Chaplin, 2007; Quitadamo & Kurtz, 2007; Quiadamo, et al, 2008; Chanchaichaovivat et al, 2009; White et al, 2009; Garril, 2011). Rahayuni (2016) suggests that the learning model of Community Technology Science (STM) is also effective to improve critical

thinking skills. Critical thinking skills and metacognition skills can be expressed from the learning process on abstract concepts. One of the abstract concepts in biology involves a physiological process that involves the study of anatomical structures and their relation to the bioprocess that occurs therein. Based on this background, then conducted the research on the correlation of metacognition skill with critical thinking skills. Research is associated with one of the physiology concepts of human excretion system. The excretion system as part of physiology is one of the most difficult concepts to understand and abstract (Lazarowitz and Penso, 1992). The processes that occur in the excretory system have the potential to require students to develop critical thinking skills during their study.

METHOD

This research used correlational method. Participants in this study were 100 students of class XI Natural Science academic year 2014 selected randomly from five different schools in Tasikmalaya City. The research instruments which used include the essay item test for capturing the metacognition skill. The essay item is refer to metacognition indicators of Schraw & Dennison (1994). The multiple choice-reason item with essay item for capturing the critical thinking skills is refer to the critical thinking indicators of Ennis. All these instruments are structured with the concept of the human excretion system.

RESULT AND DISCUSSION

1. Metacognition

The students' metacognition on the concept of human excretory system that were captured from 100 students have a low average value of 35.79. The highest value that can be obtained by students was 62.50 while the lowest value was 12.50. These values are the result of converting the overall score of the indicator to a scale of 100. The score for each maximum indicator is 3 points.

Figure 1 shows the student achievement on each sub component of metacognition. The mean scores for each sub-component are respectively from sub-components of declarative knowledge, procedural knowledge, conditional knowledge, planning, strategy of setting information, monitoring the understanding, strategy for correcting the errors, and evaluating of 0.73; 1.35; 1.32; 1.28; 1.08; 0.87; 0.62; 1.39. Based on Figure 1, it is concluded that the highest average score of students is only 1.39 for the evaluation subcomponent (number 8). The lowest average score is 0.62 for the sub component of debugging strategies (number 7).

The acquisition value of metacognition skill in general can be said very low. With an average value of 35.79 and the average score for each sub component under two points. This is not surprising because the skill of metacognition is a higher order thinking skill (King et al, 1998) so it is not easy to be owned by students. Metacognition skill is built by knowledge of cognition and regulation of cognition (Flavel, 1979). Both components must be mastered together to form metacognition. If a person has only knowledge of cognition then it will only be a normal cognitive skill. One's cognition must be actively controlled (Livingston, 1997). Regulation of cognition is needed to maximize the application of cognition that has been owned.

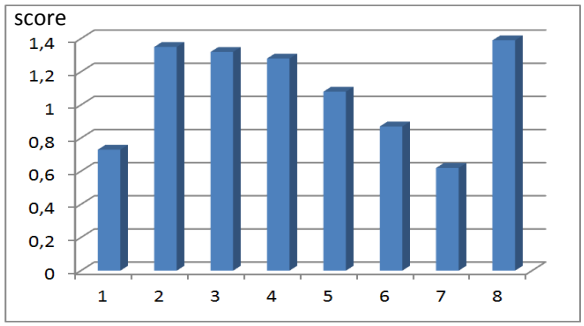
The evaluation sub component has the highest average score. But the achievement seems to be in vain because the sub component correcting the errors to the lowest score. The low metacognition skills as a whole can also be caused by the lack of declarative knowledge. Declarative knowledge should ideally be the most basic knowledge for students to have because it deals with what it is or facts (Dahar, 1996). The low average sub-component score makes the knowledge component of cognition very weak.

2. Critical Thinking Skills

The average value of students' critical thinking skills on the material of the human excretory system was not much different from the average metacognition skill of 35.23. The highest value is 73.33 and the lowest is 17.11. The average score of the students on the elementary clarification indicator, basic support, inference, strategy and tactics are respectively 1.28; 0.57; 0.95; and 1.49. Based on Figure 2, the indicators of strategy and tactics ranks first for the highest average score. The average lowest score is on the basic support indicators.

The average score for each sub-indicator of critical thinking skills can be seen in Table 1. The sub-indicators analyzing the argument ranks first as the highest average score. While the sub-indicators of observation ranks the lowest average score.

Critical thinking skills should be familiarized with students because that skill can not arise automatically. Generally, students whose become the participants of research do not experience learning with methods and models that can help students in developing critical thinking skills.



1:Declarative Knowledge
2:Procedural Knowledge
3:Conditional Knowledge
4: Planning
5: Information Management Strategies
6: Comprehension Monitoring
7: Debugging Strategies
8: Evaluation

Figure 1. Graphic of Rates Score of Each Sub-Component of Metacognition

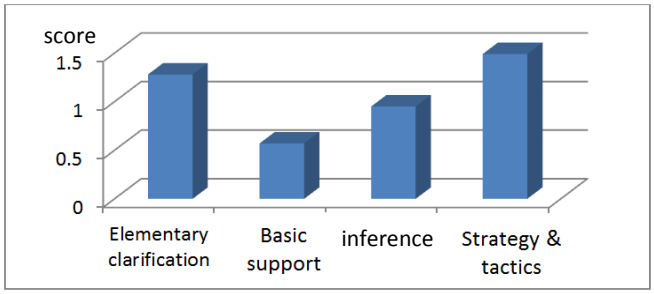


Figure 2. Graphic of Achievement Indicator of Critical Thinking Skills of Human Excretory System

Table 1 the Average of Score of Sub Indicators of Critical Thinking Skills

Indicator	Sub Indicator	Average Score
Elementary clarification	Focusing on questions (identifying or formulating questions)	1,52
	Analyzing the argument / point of view (analyze the reasons presented)	1,61
	Asking and answering a question of clarification & challenge	0,71
Basic support	Assessing the credibility of a source (ability to reason)	0,64
	Observing and assessing the observation results	0,50
Inference	Making induction and considering the induction result	0,95
Strategy and tactics (setting the strategy and tactics)	Define actions (formulate alternative solutions)	1,49

Table 2 Correlation Value of Metacognition Skills with Critical Thinking Skills

Correlation	Correlation Value			Significance
	Spearman	Kendall's tau	Pearson	
Metacognition and Critical Thinking	0,540	0,404		0,000

The methods and models in question are inquiry-based learning, problem solving, case studies, lab activities, essay writing and STM (Chaplin, 2007; Quitadamo & Kurtz, 2007; Quiadamo, et al, 2008; Chanchaichaovivat et al, 2009; White et al, 2009; Garril, 2011); and Rahayuni, 2016).

3. Correlation of Metacognition with Critical Thinking Skills

The correlation value between metacognition with critical thinking is obtained through Spearman and Kendall's test because the data of critical thinking skill is not normally distributed. Based on the correlation test,the value (correlation coefficient) are 0.540 and 0.404 it can be concluded that metacognition correlates positively and is strong enough.

The value of students' metacognition is almost the same as the value of critical thinking skills. This can be seen from the average value of both ability and skill. Positive correlation between metacognition skill and critical thinking can be proven from the value of correlation between the two. These findings are consistent with the results of the studies of Ku & Ho (2010) which show that, a person with good critical thinking has better metacognitive activity. But in the research is not known how much the value of correlation between the two capabilities.

Critical thinking skills are in the cognitive area while metacognition is at the upper level of the cognition area. Students with low cognitive skill may be assumed to have low metacognition capabilities as well. Cognition is one component of metacognition. Flavel (1979) defines metacognition as knowledge of cognition and cognition control. Although the results of this study showed that students with the highest scores on metacognition are not the highest scores on their critical thinking skills. However, students with high scores on metacognition tend to have high scores on their critical thinking skills as well. Vice versa, students who have low scores on metacognition tend to also lower the value of critical thinking skills. Halpern (in Magno, 2010) reveals that critical thinking skills are a product of metacognition.

The cognition held by a student is not just a must-have but also controlled its use. Control in question is in the form of monitoring, controling and evaluating. The control is intended to develop metacognition. According to Presseisen (in Costa 1985), learners should actively monitor the use of their thought processes and organize them according to cognitive goals. If the students' cognition on the concept of the human excretory system is low then the

regulation of cognition also tends to be low. The statement is reinforced by searching for average scores for components of cognition knowledge and regulation of cognition. The average score for the component of cognition knowledge was 1.13 and the average score for the regulation of cognition component was 1.05.

Declarative knowledge can be said to be the basis of cognition knowledge. The low level of students' declarative knowledge can influence low achievement on all indicators of critical thinking skills. Declarative knowledge expresses the knowledge of what something is (Dahar, 1996), then this knowledge becomes the basis for students to reason. Such knowledge can be linked directly to two sub-indicators of critical thinking which have the lowest proportion of achievement, for example observation and assessment of observation results. When the students do not know the object they observe, it is very likely that the students are unable to produce observational data and judge it correctly. The lack of declarative knowledge will also have an impact on the low ability to answer clarifying questions and challenging.

The sub-components of an information regulatory strategy also play an important role in supporting students' critical thinking skills. This strategy is concerned with the preparation of the material to be studied in an orderly framework (Weinstein and Mayer in Dahar, 1996). If students create effective and efficient strategies in organizing information related to the kidneys, liver, lungs and skin, then the concept of the human excretory system will be well understood. This subset of information regulatory strategies is not only related to three sub-indicators of critical thinking (low achievement) but with overall indicators.

CONCLUSION

Metacognition is positively and significantly correlated with critical thinking skills of the concept of human excretory system. The correlation coefficient between the two capabilities shows a moderately strong correlation. The sub component of metacognition that showed the highest achievement was evaluation and the lowest achievement was debugging strategies. Indicators of critical thinking skills with the highest and lowest achievement in sequence are strategy and tactic and basic support.

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