Profile metacognitive awareness of biology education students in microbiology course

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Abstract. Metacognitive ability refers to self-cognitive awareness and the process of how cognitive works and how to manage them. The lack of metacognitive ability causes students to get less able to use appropriate learning strategies that will affect the cognitive abilities. This study aims to determine the profile of metacognitive awareness of students of the microbiology course and the relationship between metacognitive awareness and the ability to understand the concept of microbiology. The subjects of the study were 28 students who took microbiology courses at Educational Institutions and Teachers in West Java. The metacognitive data awareness was collected using the Metacognitive Awareness Inventory (MAI) and the understanding ability measured by multiple choice test. Data were analyzed using descriptive statistics. The conclusion shows that students metacognitive ability in the microbiology course is still low. The percentage of student's metacognitive ability criterion showed less indication (32%), enough (43%), good (25%). There is a relationship between the metacognitive awareness criteria and the ability to understand the basic concepts of microbiology. Students who have less and enough metacognitive awareness criteria obtained understanding ability score lower than the good criteria.

1. Introduction

One factor that influences the learning outcomes of microbiology is the use of learning methods. Based on the results of the field study, the most dominantly used learning methods include lecturing and discussion. The methods tend to encourage students less to think higher level. Thus, one of the solutions to improve students' thinking ability is to build metacognitive ability. The most common distinction in metacognition separates metacognitive knowledge from skills. The former refers to a person declarative knowledge about the interactions between a person, task, and strategy characteristics [1], while the latter refers to a person procedural knowledge for regulating one problem solving and learning activities [2]. The conditional knowledge about what to do when is sometimes considered as metacognitive awareness and declarative knowledge [3]. Metacognitive is understood as high-level cognitive skills used to monitor and regulating cognitive processes such as thinking, learning, reasoning, understanding, and problem-solving [4]. There are two metacognitive aspects of metacognitive control that require cognitive processes and metacognitive knowledge: cognitive knowledge or self-awareness related to knowledge [5]. There are three components of metacognitive knowledge: declaration, procedural, and conditional knowledge. The four components of metacognition skills are predicting, planning,

monitoring, and evaluating [6]. Metacognitive is important for successful learning because the metacognitive aspect enables individuals to better manage their cognitive skills [7]. Metacognitive skills emerge at the age of 8 to 10 years and expand during the years after that [2,8]. Moreover, certain metacognitive skills, such as monitoring and evaluation, appear to mature later on than others (e.g., planning). Another result of research has shown that the behavior of very young children (5 yr. olds) may reveal elementary forms of orientation, planning, and reflection if the task is appropriated to their interest and level of understanding [9]. The metacognitive abilities of students can be empowered through methods or learning models. In the implementation of learning, teachers often only ask students to learn, but rarely teach students how to learn. Such learning will impact students with low metacognitive skills. This study used a metacognitive framework that argues that the metacognitive system plays a role in monitoring, evaluating, regulating all types of thinking. In the new taxonomy, the metacognitive system has four functions: specifying goals, process monitoring, monitoring clarity, and monitoring accuracy [10]. An issue of particular importance to educators is whether metacognition is general by nature, or rather task the and domain specific. General metacognition may be instructed concurrently in different learning situations and may be expected to transfer to new ones, whereas specific metacognition has to be taught for each task or domain separately. Much research on metacognition only pertains to one specific task or domain, such as reading and text studying [8,11].

The purpose of this study was to find out the criteria of student's metacognitive awareness in the microbiology course and so determined to see the relationship between metacognitive awareness criteria and understanding ability at microbiology concepts. The results of this study are expected to be useful in describing the student's metacognitive ability so that it can be used in developing lecturing program of microbiology oriented to various methods or models of teaching that can empower metacognitive ability. Based on this information, the results of this study can be recommended to develop a microbiology course based on metacognitive.

2. Method

This study used the descriptive qualitative method. The research subjects consisted of Biology Education students at Educational Institutions and Teachers in West Java. The participant is 28 students. Metacognitive awareness is measured using the Metacognitive Awareness Inventory (MAI). The ability of understanding measured by a multiple-choice instrument that offers the reason why the answer is correct or the answer is wrong. The research procedure begins by making a metacognitive instrument rating, with metacognitive indicators covering aspects: Planning, monitoring, evaluating. Subsequently, the researcher created a metacognitive instrument that adapted to MAI. It consists of positive statements and negative statements, with responses, strongly agree, agree, disagree, strongly disagree. For positive statements include strongly agree on responses (Score 4), agree (Score 3), disagree (Score 2), strongly disagree (Score 1), while the negative statements suggest otherwise. To examine metacognitive awareness criteria, using Likert scale was used, by providing very good, good, enough, fewer criteria. The ability of understanding is measured by determining the score. The collected data were analyzed using qualitative descriptive statistics.

3. Result and discussion

Metacognitive awareness consist of knowledge and regulation of cognition becomes strategy and skills that encourage learners to solve problems and think high level. Metacognitive regulation is the regulation of cognition and learning experiences through a set of activities that help people control their learning. Metacognitive awareness defined abilities within do reflection, understand, and control learning. Metacognitive activity usually precedes and follows cognitive activity, so the two are closely interdependent. The ability to manage, monitor, and evaluate cognitive activity is at the core of metacognitive ability.

Another opinion about metacognitive is the process of thinking about students' thinking and the ability to use learning strategies appropriately. The metacognitive ability of students can be empowered through methods or learning models. In the implementation of learning, teachers often only ask students

to learn, but rarely teach students how to learn. Such learning will impact students with low metacognitive skills. The low metacognitive ability of students will affect students' cognitive thinking ability. One of the factors that because low metacognitive ability is the implementation of the lesson learning methods that are less empowering metacognitive ability of the lecture method. Figure 1 shows that student's metacognitive awareness is largely on enough criteria (B=43%) and less (A=32%) and few on good criteria (C=25%) and none is very good.

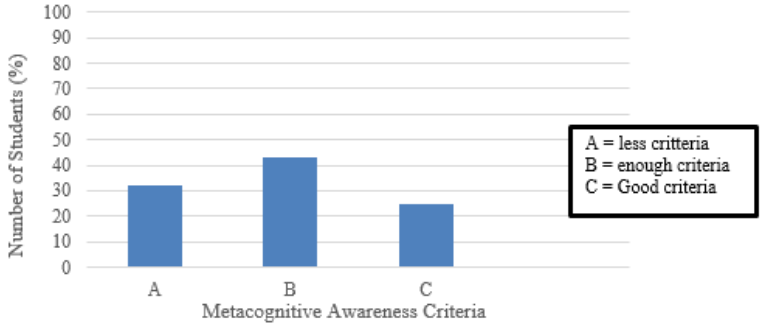

Figure 1. Student metacognitive awareness.

Figure 1 shows that the metacognitive awareness of students in microbiology lectures is still low. The percentage for each metacognitive awareness criteria indicates that students who get good criteria included seven people (25%), enough criteria 12 people (43%), fewer criteria nine people (32%), and no one gets very good criteria. The results another research of student's perceptions of metacognitive settings show that about half of the students can monitor, evaluate, and plan the learning strategies they use to prepare for the exam [12]. Metacognition need not be studied in splendid isolation. A large group of researchers is involved in determining the complex relations between metacognitive experiences, epistemological beliefs, metacognitive knowledge, and self-regulation on the one hand, and motivational processes, self-efficacy, and study interests on the other [13]. We need to know a lot more about how individual differences and contextual factors interact with metacognition and its various components.

Further, feedback from the instructor can positively increase students' ability to self-monitor and generate internal feedback. The results of other studies explain that the writing assignment method with the metacognitive component that can improve learning in the introductory course of biology [14,15]. Table 1 indicates a relationship between the metacognitive awareness criteria and the score of understanding at microbiology concepts.

Table 1. The relationship between the metacognitive awareness criteria and the score of understanding ability.

Criteria for metacognitive Awareness	Score of understanding ability	Number of student
Less	10	6
	20	3
Enough	10	6
	20	4
	30	2
Good	20	1
	30	2
	40	4
Very good	-	-

Figure 2 shows that correlated between metacognitive awareness and the scores of understanding ability. The result of this research obtained less, enough and good criteria.

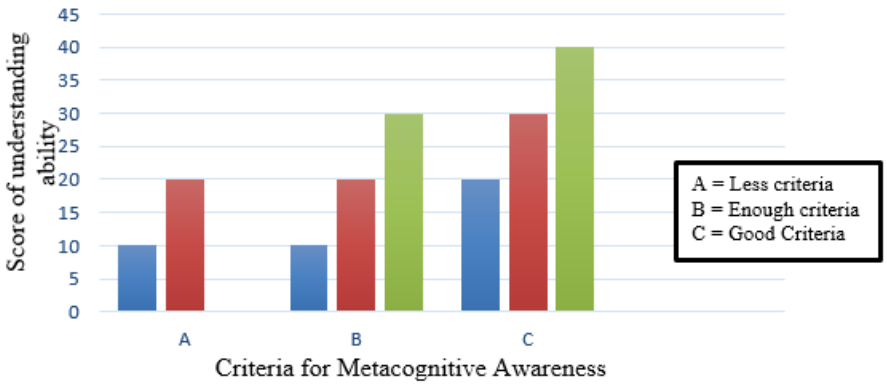

Figure 2. The graph of the relationship between metacognitive awareness criteria and a score of understanding ability.

Figure 2 showed that the result of the metacognitive awareness criteria is less and enough to obtain lower understanding ability score compared with good criteria (table 1). This proves that metacognitive ability is very closely related to cognitive abilities. This research is important to improve student achievement through learning method or model that can empower metacognitive ability. Some methods or learning model can empower metacognitive ability.

The result of research another that there were differences in learning outcomes between student's high metacognitive skills and low metacognitive skills [16]. The use of the metacognitive ability is essential when improving their understanding of concepts or relationships between concepts [17]. Other studies have shown that metacognitive regulation through the rubric of critical thinking and problem-solving processes can improve critical thinking skills [18]. There are differences in learning outcomes of science in learning using metacognitive support and cognitive support [19]. There is a kind of learning assignments with a metacognitive component that improves student learning achievement. Some relevant studies suggest that writing assignments interfered with metacognitive components that will improve student learning achievement [14]. Reading strategies interfered with metacognitive components that improve student learning achievement [20]. The same study concludes that metacognitive skills and reading strategies can improve the introductory learning outcomes of Biology [21,22]. Female biology students are more likely to use metacognitive reading strategies than male students [23]. Metacognitive awareness of reading strategies used three factors global reading strategies, problem-solving reading strategies, and support reading strategies to determine the level of student's metacognitive awareness and strategies while reading school textbooks [24]. Metacognitive awareness reading strategies used by students while reading academic material is one of the factors that lead to student's future academic achievement. In this study, most of the students apply problem-solving strategies compared to the other metacognitive reading strategies, but there is no significant difference between males and females. Global reading strategies are the least used strategy among the metacognitive reading strategies, with the females using this strategy more than the males [25]. Other studies have shown that metacognitive regulation through the rubric of critical thinking and problem-solving processes can improve critical thinking skills [26]. Incorporating self-assessment into the classroom will help students move toward a regular self, lifelong learning with independence capable of confronting various challenge [26].

4. Conclusion

The student's metacognitive awareness in microbiology course is still low. The number of students in each of the metacognitive ability indicated less criterion (32%), enough criteria (43%), good criterion (25%). There is a relationship between the metacognitive awareness criteria and the understanding ability at the basic concepts of microbiology. Students who have metacognitive awareness criteria are less and enough obtain understanding ability scores lower than good criteria.

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