Students' Metacognitive Skill Level of Biology Education Study Program

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Abstract. Students require metacognitive skills to be able to learn autonomously and deliberately plan, monitor, and assess their learning process in order to get the most out of their learning experiences. For lectures to design effective learning tactics, it is critical to understand the level of students' metacognitive abilities. By using a survey method, this study attempted to gauge the level of metacognitive abilities of Biology Education Study Program students at Universitas Negeri Padang. 279 students made up the research sample (entry years 2017, 2018, 2019, and 2020). The questionnaire from the Metacognitive Awareness Inventory was used to gather data. According to this study, students' metacognitive abilities overall were 75.97 percent on average (good category). Metacognitive understanding received an average score of 76.05 (excellent category), while metacognitive regulation received an average score of 75.93. (good category). It may be said that the student's metacognitive abilities are strong in the Faculty of Mathematics and Natural Sciences, Universitas Negeri Padang's Biology Education Study Program.

Keywords: Metacognitive skills · Metacognitive knowledge · Metacognitive regulation · Metacognitive awareness inventory

1 Introduction

Renewal in the higher education curriculum requires lecturers to apply student-oriented learning. In this situation, the lecturer facilitates and inspires the learning process. Lecturers provide learning stimuli, and clear instructions to direct students so that they learn according to their capacities, and develop their potential according to their abilities and learning independence. College graduates who are knowledgeable, capable, creative, and independent are characterized by their ability to think critically and creatively in various situations and conditions.

Students who have an average age of 18 to 23 years are included in the subject of adult learning or what is known as andragogy. Adults have a wealth of experience, knowledge, skills, and ability to handle life's challenges on their own, claims [1]. Furthermore, he stated that the self-concept of adults is no longer dependent on others, and has the ability

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and experience to make decisions independently [1]. Therefore, the learning strategies used in adult learning have special characteristics that are different from learning in children. One of the characteristics of andragogy learners is that they have potential self-regulation abilities to be developed into real-world life skills through the lecture process.

According to Knowles, there are four assumptions of andragogy and pedagogical learning, namely adults: (a) have an independent self-concept, (b) have many learning experiences so that it will provide the basis for learning something new, (c) have the readiness to learn, (d) the learning orientation is centered on solving life problems [2]. Therefore, students who are adult learners are able to carry out independent learning. In independent learning, it is the learner who decides what to learn based on his own needs. This is in line with one of Knowles' principles of adult learning, which stipulates that adults must be active in creating learning objectives and comprehending the degree to which results are accomplished.

The implications of the four assumptions on adult learners such as students, teachers or lecturers must be able to choose learning strategies that support student independence or self-dependence. Independent learning of students in principle is required in all courses. One of the efforts to form student learning independence is to apply metacognitive strategies in lectures. In order for students to be successful in applying metacognitive strategies, they are required to have metacognitive skills.

Many researchers have conducted research to determine the metacognitive skills of students at various levels of education. The results of [3] concluded that related to the learning independence of Indonesian students, problems were found, where the main weakness lay in their skills in managing themselves while studying) [3]. Self-management while studying is the main key to independent learning. The results of research by [4] reveal that students' metacognitive abilities are at the level of "cannot really" (unable to separate what they think and how they think) and "at risk" (students do not appear to have awareness of thinking as a process [4]. Research in Jordan (2019) on talented students shows the level of students' metacognitive skills is high [5]. Research conducted by [6] in 2019 on grade VII, VIII, IX, X, and XI students in Malang informed that students' metacognitive skills were "very low", and the level of education has a significant effect on students' metacognitive skill [6]. Research conducted by [7] at the University of Trunojoyo Madura informed that students' metacognitive skills in Science Education Study Program after undergoing lectures using the ethnoscience method enhanced well [7].

In the Biology Education Study Program at Universitas Negeri Padang, no research has been done to yet to ascertain the level of students' metacognitive abilities. It is necessary for lecturers to be aware of the level of their students' metacognitive abilities in order to implement the proper learning models and tactics in lectures. Therefore, the authors conducted a study to determine the level of their metacognitive skills through a survey using a metacognitive awareness inventory questionnaire.

2 Theoretical Review

The concept of metacognition was originally developed in the context of the study of information processing. Flavell in 1976 was one of the experts who proposed a description of metacognition. Metacognition, according to Flavell, is the control of one's cognitive activity during the learning process as well as knowledge of one's own cognitive processes, products, or anything associated with them. He also said that metacognition is an information processing activity [8].

Metacognition is also defined simply by experts as "thinking about thinking" or "self-regulation" of students in learning. In the case of a student applying metacognitive strategies, he is aware of the plans he has made, the learning process he is implementing and he is able to measure how efficient the learning strategies he has applied to achieve learning goals. The application of metacognitive strategies will improve student self-regulation in learning [9]. Metacognitive involves activities such as planning how a task can be done, monitoring the level of understanding, and evaluating the progress of the task at hand [10].

Flavell divided metacognition into two groups, namely metacognitive knowledge and experience or metacognitive regulation. Knowledge of one's own cognitive processes and information on various techniques for controlling those processes can be grouped into metacognitive knowledge, which is further subdivided into three categories: (1) knowledge about people variables, (2) knowledge about task variables and (3) knowledge about strategy variables. How students control their thinking to facilitate learning is called metacognitive regulation [9].

The term metacognition was introduced by Flavell in 1976. According to Flavell, "metacognitive knowledge and metacognitive experience or regulation" are the two fundamental components of metacognition. He also made use of the term "cognitive monitoring," which he used to relate metacognition and self-regulated learning. [4].

Metacognitive experience or regulation, according to Flavell, is made up of metacognitive knowledge [9]. The development of metacognitive knowledge—knowledge that can be applied to control cognitive processes—refers to learning about cognitive processes. Metacognitive experiences, on the other hand, are techniques that can be used to regulate cognitive processes and accomplish cognitive objectives.

Metacognitive skills are important for students because it will help them to understand their own learning process and how they can learn effectively. Students' metacognitive skills have a correlation with their cognitive learning outcomes according to the results of research by experts. So that lecturers need to know the level of metacognitive skills of their students, and always enhance their metacognitive skills by applying appropriate learning models.

Students' metacognitive skills can be determined in various ways, one of which is by using a standardized metacognitive awareness inventory, where the question items are developed based on metacognitive skills variables: metacognitive knowledge and metacognitive regulation. Sub-variables for metacognitive knowledge are declarative knowledge, procedural knowledge, and conditional knowledge. Sub-variables for metacognitive regulation are planning, information management strategies, comprehension monitoring, debugging strategies, and evaluation. Indicators for each sub-variable are presented in Table 1.

Table 1. Variable, sub-variable, and indicator of metacognitive skills

Variable	**Sub-variable**	**Indicator**
Metacognitive knowledge (knowledge about cognition)	Declarative knowledge	- The factual information the learner needs to process or apply critical thinking to the subject - Knowing *about, what, or that* - Knowing one's strengths, capabilities, and resources as a learner - Through lectures, demonstrations, and conversations, students can learn.
	Procedural knowledge	- Application: the use of knowledge to carry out a task or process - understanding of how to use learning techniques (e.g. strategies) - Students must understand the procedure and when to use it in different circumstances. - Students can learn through exploration, group collaboration, and problem-solving
	Conditional knowledge	- The choice of which situations call for the transfer of particular techniques or abilities - Knowledge about *when* and *why* to use learning procedures - Applying declarative and procedural knowledge under specific circumstances - Students can obtain knowledge through simulation
Metacognitive regulation (regulation of cognition)	Planning	- Planning, goal setting, and allocating resources *prior* to learning

(*continued*)

Table 1. (*continued*)

Variable	Sub-variable	Indicator
	Information management strategies	- Skills and technique sequences (such as organizing, elaborating, summarizing, and selective focussing) used to digest information more effectively
	Comprehension monitoring	- Assessment of one's learning or strategy use
	Debugging strategies	Strategies used to correct comprehension and performance errors
	Evaluation	Analysis of performance and strategy effectiveness after a learning episode

Source:[10]

3 Research Method

This study used a survey method to assess the level of students' metacognitive abilities in the Biology Education Study Program at Universitas Negeri Padang. Using the Metacognitive Awareness Inventory Questionnaire, research data was gathered. (modified from Schraw & Dennison, 1994), which consisted of 50 statement items, where the answer of each questionnaire item is determined based on the Likert scale (with scale range 1–4).

There were 279 participants in the study, divided into four batches: the 2017 entrance year (50 students), 2018 (56 students), 2019 (118 students), and 2020 (55 students). Research carried out in March 2021. Descriptive statistics were used to examine the results of the students' responses. Each student's score is first calculated, and the percentage of scores earned is established. Furthermore, the average percentage score obtained per year of entry and per variable of metacognitive skills is also determined. The level of students' metacognitive skills is determined based on the categories listed in Table 2 (adapted from [6]).

4 Result and Discussion

According to the findings of a metacognitive skills survey conducted among 279 students in the Biology Education Study Program at the Faculty of Mathematics and Natural Sciences at Universitas Negeri Padang, metacognitive skills were generally rated at an average of 75.97 percent (good category). When compared to the average score for metacognitive control, which is 75.93, the average for metacognitive knowledge is

Table 2. Categories of Metacognitive Level

Scores	Categories
86–100	Very good
76–85	Good
60–75	Enough
55–59	Low
0–54	Very low

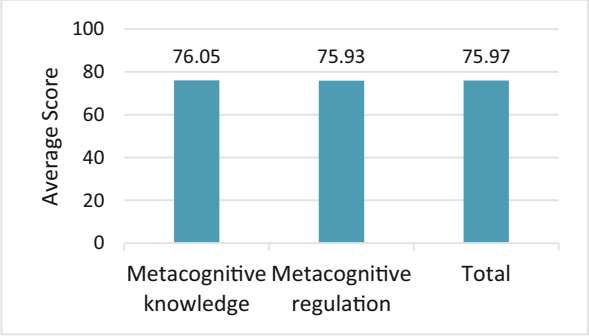

Fig. 1. Average Score Variable

76.05 (excellent category) (good category). Students' metacognitive skill scores based on variables are shown in Fig. 1.

Figure 1 shows that the average score of students' metacognitive skills on the metacognitive knowledge variable is almost the same as the average score of metacognitive skills on the metacognitive regulation variable (good category), and the total score is also good category. This finding is supported by a study conducted by Coskun which revealed that college students have a high level of metacognitive skills, and there is an increase in the level of metacognitive skills along with an increase in grade level [11]. There is a difference in the metacognitive skills of secondary school students which are generally low based on the findings of [3] and [4].

Students' metacognitive skills based on entry year are shown in Fig. 2.

Figure 2 shows that the metacognitive skills of each student level are almost the same, namely in the good category. However, the metacognitive skills of fourth-level students are low compared to lower-level students.

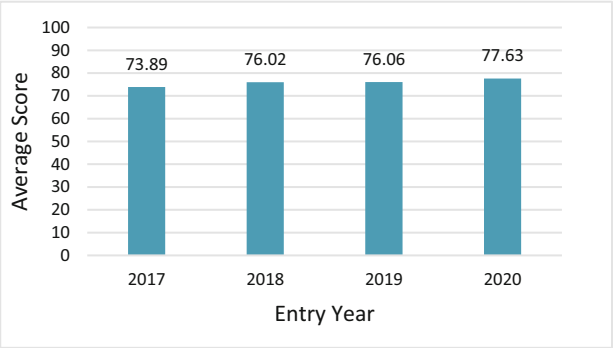

Fig. 2. Average Score per Entry Year

5 Conclusion

In terms of metacognitive knowledge and metacognitive control, it can be said that the Biology Education Study Program students at the Faculty of Mathematics and Natural Sciences at Universitas Negeri Padang have generally strong metacognitive skills.

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