Mastery of Meta-Cognitive Skills on Biology Material for Senior High School Students in Palembang

Kodri Madang, Masagus Mhd. Tibrani*, Rahmi Susanti

Biology Education Department, Universitas Sriwijaya, Indonesia
**Corresponding author. Email: m_tibrani@fkip.unsri.ac.id*

ABSTRACT
This study aims is obtaining students' meta-cognitive skills on biology material for senior high school in Palembang. A number of senior high school students at Palembang, South Sumatera, Indonesia, were involved as participants in this study. The data were collected using meta-cognitive skills test instrument. Research results show that there are several positions of meta-cognitive skills based on its parameters, as much as 51.86 % of senior high school students stated that have conditional knowledge, 46. 98 % have declarative knowledge, 0.93 % have Information management strategies, and 0.23 % have comprehension monitoring and evaluation. That mean is more than 50% of senior high school students just have knowledge meta-cognitive but do not have regulation meta-cognitive. The scores of students' meta-cognitive skills on biology material are 34.84. It shows that students' meta-cognitive skills in biology materials are very low. Therefore, changes to biology learning strategies are needed.

Keywords: *Biology materials, Knowledge meta-cognitive, Meta-cognitive skill, Regulation meta-cognitive.*

1. INTRODUCTION

The era of industrial revolution 4.0 changed various social aspects such as health, finance, mobility, and infrastructure. A large amount of information from physical space accumulates in cyberspace. In cyberspace, big data was analyzed by artificial intelligence (AI) and will back to humans in physical space in various forms [1]. In construction of society 5.0, the currently attending school children are future owners that full of turmoil, uncertainty, complexity, and unpredictability. The three abilities such as solve complex problems, critically thinking, and be creative is needed. The development of these abilities is the responsibility of the world of education. Efforts to resolve it are addressed both at the regulatory level and through the search, research, and implementation of innovative educational approaches and strategies [2]. Education contributes to the development of the nation because it can produce quality human resources [3] .

The development of education in Indonesia should have referred to a new perspective, namely referring to the skills needed for the industrial revolution 4.0, society life 5.0, and the 21st century. The learning process is not sufficiently equipped with knowledge but also thinking skills. The empower various skills and potentials of students are responsibility of the Educators [4]. Teachers were able to give students opportunities to develop competence by maximizing the affordances [5]. Therefore, Education in Indonesia has qualification standards for graduates at every level including high school. Education in Indonesia has qualification standards for graduates at every level including senior high school.

Senior high school education standards are integrated in the form of learning outcomes for both formal and non-formal education. This learning outcomes were abilities obtained through internalization of knowledge, attitudes, skills, and competencies. Therefore, educational institutions must make graduates who have the skills to be used in their lives. These learning outcomes show that high schools have a goal to establish graduates who are competent in their fields both cognitively, effectively, and performance. Competence is the need to interact effectively with one's environmental surroundings, to seek out optimal challenges, take them on, and exert persistent effort and

strategic thinking to make progress in mastering them [6]. One of material could encourage this learning outcomes is biology.

Biology is a science of life. Based on the concepts learned in biology, this science requires students to understand, analyze, link and compare of organism's life. Biology learning prepares students with biology concepts that can be understood and applied in their lives [7]. Based on the results of syllabus and Course Program Plans (CPP), generally teachers were carried out using varied learning methods. This teacher-centered learning process results in underdeveloped student thinking skills. Students were forced to take part in learning which results in the lack of independence, mastery of concepts, attitudes, and morals [8], [9]. Finally, the exam results of biology material showed an average of 60 (low). These results were thought out by students have not been trained or skilled in using their cognitive (thinking about thinking) or meta-cognitive skills.

Meta-cognitive skills have a role in the development of students' ability to analyze, complete tasks, monitor, care, make decisions, improve performance in learning [10 – 14]. This type of cognition regulates thinking and learning and consists of three self-assessment skills: planning, monitoring, and evaluating [15]. In Meta-cognitive skills had significantly relationship with students' academic achievement, critical thinking skills, and scientific attitudes [16–19]. The empowerment of meta-cognitive skills needs a time and process because everyone has different ability to realize and regulate their cognitive. Meta-cognitive activities involve mental activities, which by their nature cannot be observed directly [20]. As obtained in research, students with good meta-cognitive skills can provide good results for learning [21]. Individuals with these skills can monitor their learning; know how to spare time for their studying and the most effective way to followed [22].

Based on the exam results of the biology materials and it was suspected because by the low meta-cognitive skills of students. There is no information about mastery of meta-cognitive skills on biology material for high school students. Therefore, a survey was conducted to prove this suspicion by describing the meta-cognitive skills of high school students is needed. The statement of problem in this research was how the mastery of high school students' meta-cognitive skills on biology materials. This study aims to obtaining the value and position of meta-cognitive skills indicators of high school students on biology materials. The results of this study were expected to provide information on the meta-cognitive skills mastery of high school students. This information is needed for teachers or stakeholders to make a revision on instructional that could develop their meta-cognition.

2. METHOD

2.1. Types and Research Sample

This descriptive research was conducted using survey method. This study was conducted in August 2020 by distributing meta-cognitive skills assessment instruments to the research samples. The samples in this study were senior high school students in Palembang, Indonesia at 2020-2021 academic years. The study sampled 430 students consisting of 285 women and 145 men.

2.2. Research Instruments

The instrument used in this study was an instrument for measuring meta-cognitive skills, called achievement test items (meta-cognitive skills integrated with cognitive) and indicators of meta-cognitive skills rubric scoring (Table 1). Achievement test items made in the form of essay question containing levels of thinking based on Bloom's revised taxonomy of 4 questions. The distribution of questions is based on biology topics, for example digestive system integrated social case. The meta-cognitive skills question was integrated into the cognitive of three items consisting of the achievement of analytical competence (C4), evaluation (C5), and creation (C6). This item which has analytical thinking, evaluation, and creation level contains meta-cognitive skill parameters, such as declarative knowledge, conditional knowledge, information management strategies, and comprehension monitoring and evaluation. Meta-cognitive skills assessment used the developed meta-cognitive skills assessment rubric [23]. The distribution of this items was by online using Google-forms.

2.3. Research Procedures

This research was carried out through several stages; preparation, data collection and analysis of research results. In the preparation stage, the researcher develops an achievement test items of 8 questions. After the validation process, four items were obtained. At the data collection stage, the researcher distributes the items to the research samples for 100 minutes by online. The answers obtained were checked both for concept gaining and combination of concept gaining-meta-cognitive skills scores. The concept gaining scores checked by the cognitive learning outcomes rubric. The combination of concept gaining-meta-cognitive skills scores checked by meta-cognitive skills assessment rubric. The students tend declarative knowledge if have score 0-2 of meta-cognitive skills rubric, tend conditional knowledge if have score 3-4 of meta-cognitive skills rubric, tend information management strategies if have score 5 of meta-cognitive skills rubric, and tend comprehension

monitoring and evaluation if have score 6-7 of metacognitive skills rubric.

Table 1. Meta-cognitive skills assessment rubric

Score	Description
7	The answer is written in their own sentences. The order of answer is harmonious as well as systematic. The answer is logic in correct grammar, supported by explaining reason (analytic, evaluative, or creative explanation), and the answer is correct.
6	The answer is written in their own sentences. The order of answer is harmonious as well systematic. The answer is logic in less correct grammar, supported by explaining reason (analytic, evaluative, or creative explanation), and the answer is correct.
5	The answer is written in their own sentences. The order of the answer is less/inharmonious as well as less/unsystematic. The answer is less/ not logic in less correct grammar, supported by explaining reason (analytic, evaluative, or creative explanation), and the answer is correct.
4	The answer is not written in their own sentences. The order of answer sentences is harmonious as well as systematic. The answer is logic in correct grammar, supported by explaining reason (analytic, evaluative, or creative explanation), and the answer is correct.
3	The answer is not written in their own sentences. The order of answer sentences is less/inharmonious as well as less/unsystematic. The answer is less/not logic, in less correct grammar, supported by explaining reason (analytic, evaluative, or creative explanation), and the answer is correct.
2	The answer is not written in their own sentences. The order of answer sentences is less/inharmonious as well as less/unsystematic. The answer is less/not logic, in less correct grammar, not supported by explaining reason (analytic, evaluative, or creative explanation), and the answer is less correct.
1	The answer is not written in their own sentences. The order of answer sentences is less/inharmonious as well as less/unsystematic. The answer is less/not logic, in less correct grammar, not supported by explaining reason (analytic, evaluative, or creative explanation), and the answer is not correct.
0	There is no answer at all

The scores were obtained then converted to a scale from 0-100. Conversion of scores using the following formula:

$$\frac{\text{Totally score}}{\text{Maximum score}} \text{ x } 100 \qquad \text{(a)}$$

Converting scores of meta-cognitive skills using the following formula:

$$\frac{y1+2x}{3} = y2 \qquad \text{(b)}$$

Notes:

x: Meta-cognitive skill scores

y1: Concept gaining scores

y2: Combination concept gaining-meta-cognitive skills scores

The meta-cognitive skills scores then used as data in this study.

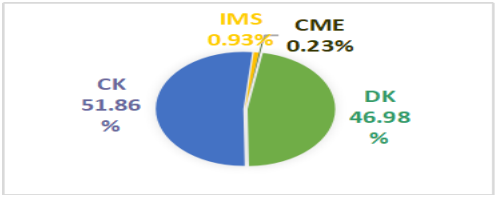
2.4. Data Analysis

The data were analyzed with descriptive statistics. The statistics used with the help of the IBM SPSS version 22. The mean from measurement scale is then used to categorize the level of meta-cognitive skills that refer to the learning outcomes assessment standard, which is very low (0-40.99), low (0-40.99) 41-55.99), enough (56-70.99), high (71-85.99), very high (86-100). Furthermore, to see the position of meta-cognitive skills of students is done by calculating the frequency of answers obtained based on the rubric of meta-cognitive skills.

3. RESULT AND DISCUSSION

3.1. Result

A survey on the measurement of senior high school students' meta-cognitive skills on biology material has been carried out on 430 students. The frequency of positions of each meta-cognitive skills parameter and meta-cognitive skills scores were obtained as results of this study. The results of the survey on senior high school students' meta-cognitive skills parameters can be seen in Figure 1.



DK = Declarative Knowledge
CK = Conditional Knowledge
IMS = Information Management Strategies
CME = Comprehension Monitoring-Evaluation parameters

Figure 1. Frequency of meta-cognition skills

Figure 1 shows that there are several positions of meta-cognitive skills based on its parameters, as much as 51.86 % of senior high school students stated that

have conditional knowledge, 46. 98 % have declarative knowledge, 0.93 % have Information management strategies, and 0.23 % have comprehension monitoring and evaluation. Figure 1 showed that more than 50% of senior high school students just have knowledge meta-cognitive but do not have regulation meta-cognitive skills. The survey results about the scores of meta-cognitive skills of senior high school students in biology materials can be seen in Table 2.

Table 2. The scores of meta-cognitive skills on biology materials

	N	Min	Max	Mean	Std. Dev
Metacognitive skills					
Valid N (Listwise)					

Table 2 shows that the average scores of senior high school students' meta-cognitive skills was 34.88. Table 2 showed that the meta-cognitive skills of senior high school students were in the very low category.

3.2. Discussion

The results of this study stated that meta-cognitive skills of senior high school students in Palembang were in the very low category and more than 50% just have knowledge meta-cognitive but do not have regulation meta-cognitive skills. Meta-cognitive knowledge is that segment of your (a child's, an adult's) stored world knowledge that has to do with people as cognitive creatures and with their diverse cognitive tasks, goals, actions, and experiences [24]. *General meta-cognitive knowledge* is knowing about and being able to control and regulate problem-solving processes regardless of the specific domain from which problems or tasks are drawn [25]. Similar results have also been found in various studies.

Previous research stated meta-cognitive skills of senior high school students in Batu, East Java were in cannot really level [26]. Research [27] also stated that the meta-cognitive skills of Muhammadiyah university students are low. The low value of meta-cognitive skills that occur due to the learning process that does not emphasize the process of meta-cognition. Based on the CPP analysis, it appeared that the teacher methods conducted have varied, but the teacher activities do not emphasize the process of developing meta-cognitive skills. The teacher had preparing their lesson with the activities could empowering meta-cognitive skills but, in the learning, process, the parameters of meta-cognitive skills was not reflected. In the learning process, measurement of abilities, achievement, and/or competence cannot be separated from the important role of metacognition. Determining the metacognitive skill level of the youth as a part of education is of utmost importance for promoting students to gain meta-cognitive awareness along with the development and implementation of strategies in the improvement of this ability [24]. The student with high meta-cognitive skills performance was better than students with low meta-cognitive skills [10]. Meta-cognitive skills can be developed through a process or form of learning with regulation meta-cognitive. The empowerment of meta-cognitive skills can be done with strategies, approaches or learning models that demand cognitive regulation activities, analysis, evaluation, or creations in them. The results of the study showed that teachers who worked in a CFG felt better prepared to continue engaging in their profession. CFG provided the opportunity to work collaboratively, to delve into classroom-based dilemmas, to focus on the teaching and learning of specific academic content, and build strong working relationships among teachers [28].

In this strategy, teachers train students' skills in planning and monitoring cognitive activities and evaluating the results of each activity. The empowerment of meta-cognitive can be trained by giving students the opportunity to identify difficulties, find difficulties and acknowledge them, and integrate their reflections into their learning tasks [29].

Some learning models that are active, constructive could be used as meta-cognitive strategies, such as Problem Based Learning (PBL), Project Based Learning (PjBL), Inquiry which is integrated or integrated with other strategies or models proven to influence and improve meta-cognition [30]–[33]. Learning styles and motivation as well as the learning environment in schools and families also need to be considered in empowering meta-cognition[34], [35]. Meta-cognitive strategies through diverse strategies and combined in a learning journal have more potential to improve student learning outcome [36]. That meta-cognitive strategies for reading comprehension could improve college students' academic performance [37]. In practicing meta-cognitive skills, teachers as learning facilitators can empower them through meta-cognitive strategies. In line with the statement that the use of meta-cognitive strategies can influence the development of meta-cognitive skills [21].

4. CONCLUSION

Based on the results of research and discussion, it can be concluded that senior high school students in Palembang have meta-cognitive skills with very low category (34.88) in biology materials and more than 50% have knowledge meta-cognitive but do not yet have regulation meta-cognitive. It is recommended that in biology learning it is best to change the learning strategy as it has been used.

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