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Submission date: 11-Aug-2022 09:27PM (UTC+0700)

Submission ID: 1881383719

File name: ning_motivation_with_metacognitive_skills_in_biology_subject.pdf (315.74K)

Word count: 4257

Character count: 24626

Research Article

The relationship between self-regulated learning and learning motivation with metacognitive skills in biology subject

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ARTICLE INFO	ABSTRACT
<p>Article history Received June 30, 2020 Revised July 23, 2020 Accepted November 24, 2020 Published November 30, 2020</p> <p>Keywords Self-regulated learning Learning Motivation Metacognitive Skills</p>	<p>The latest learning in the 21st century requires learners to master various competencies to support their learning process and achieve the expected learning goals. This study aims to determine the relationship between self-regulated learning and learning motivation with metacognitive skills. The research was conducted in May 2020 at SMAN 1 Tasikmalaya. The research used a quantitative approach to explore the correlation among variables observed involving a population of 177 students of class XI MIPA 1- XI MIPA 5 in academic year 2019/2020. The samples were 43 students selected using simple random sampling technique. Metacognitive Awareness Inventory (MAI) questionnaire adapted from Schraw & Dennison and Motivated Strategies for Learning Questionnaire (MSLQ) adapted from Pintrich & De Groot were used to collect the data. MAI is used to measure metacognitive skills, while MSLQ is used to measure self-regulated learning and learning motivation. MSLQ is a validated instrument, while MAI is tested for validity first and the results are valid. The analysis technique used was multiple linear regression tests. The results show that the correlation coefficient (R) was 0.747 and the coefficient of determination (R²) was 0.558. The contribution of self-regulated learning and learning motivation to metacognitive skills amounted to 55.8%.</p> <p>Copyright © 2020, Mustopa et al This is an open access article under the CC-BY-SA license</p>  
<p>How to cite: Mustopa, N. M., Mustofa, R. F., & Diella, D. (2020). The relationship between self-regulated learning and learning motivation with metacognitive skills in biology subject. <i>JPBI (Jurnal Pendidikan Biologi Indonesia)</i>, 6(3), 355-360. doi: https://doi.org/10.22219/jpbi.v6i3.12726</p>	

INTRODUCTION

Education in the 21st century requires students to master a variety of skills, especially in the learning process so that their final learning objectives can be achieved and are expected to improve the quality of education. According to Mustofa, Corebima, et al. (2019), one way to improve the quality of education is to train students' skills such as thinking skills or other skills. However, at the moment, teaching and learning activities still tend to be oriented towards the ability to test students' memories on particular subject which resulting in inability of students to think pluralistically (Mustofa & Hidayah, 2020). In the current era, teachers are not only required to provide learning materials, but also to empower various competencies in the 21st century (Yasir et al., 2020).

Metacognitive skills and self-regulated learning are two important competencies that must be empowered to support the learning process.

Similarly, Koc and Kanduvac (2016) believe that the metacognitive study conducted in the education sector is a result of the needs and expectations that have become very essential. Teaching metacognitive skills is one of the main priorities since the 21st century that aims to develop the ability of knowledge content (Ozturk, 2017). In line with this, Bahri and Corebima (2015) explain that metacognitive skills play an important role in various cognitive activities. The aspect of metacognitive influences an individual's ability to choose, understand, and reflect the consequences of his or her behavior (Utaminingsih, 2017). Metacognitive skills lead to higher-order thinking skills that involve active control of certain cognitive processes in the learning process (Bahri & Corebima, 2015). Gagne (as cited in Mustofa, Corebima, et al., 2019) states that metacognitive skills are the ability to associate important messages in prior knowledge, draw conclusions, and to monitor or assess personal performance. Metacognitive skills enable learners to implement the process in addition to organizing the gradual learning, as well as to monitor and evaluate learning activities (Cera et al., 2013). Furthermore, it is said that metacognitive basically means thinking about thought that refers to the awareness and control of students, not only about their cognitive processes, but also their emotions and motivations as well (Papleontiou-Louca, 2003). The achievement of metacognitive skills will be realized when self-regulated learning has been developed and empowered by students.

Self-regulated learning will benefit students in their efforts to plan, monitor and evaluate each learning process. Self-regulated learning is an important aspect of students' learning (El-Adl & Alkharusi, 2020) that can identify learning goals, monitor progress, choose strategies and learning environments (McMillan & Moore, 2020; Schraw et al., 2006) and self-regulation in the learning process (Mustofa, Nabiila, et al., 2019). Zimmerman (1990) states that the main key to self-regulated learning is the systematic use of metacognitive, motivation and behavior. Self-regulated learning will make the learners aware of the mental processes they rely on when doing cognitive tasks and manage learning activities (Cera et al., 2013).

The role of self-regulated learning will make students become active learners in the learning process therefore can optimally empower metacognitive skills. However, apart from that, students also need motivation as a first step to start all forms of learning activities. Motivation is an important process for students to start and maintain learning activities (Oguz & Ataseven, 2016), instigate and maintain activities directed at the goals (Schunk & DiBenedetto, 2019). Motivation refers to the reasons underlying behavior that is characterized by will and determination (Lai, 2011b). According to Mubeen and Reid (2015), motivation is seen as a condition from within or a power that energizes directs and maintains behavior towards achieving a goal. Thus, motivation will provide encouragement to carry out systematic learning activities together with self-regulated learning and as a result it can develop metacognitive skills.

Metacognitive skills and self-regulated learning supported by learning motivation are needed in the learning process that requires specific strategies so that learning goals can be achieved. Biology is one of the subjects in which many various definitions or terms are in Latin and students are required to understand and even memorize them. Hindun et al. (2020) explain that by empowering metacognitive skills will make students actively participate in learning Biology. Metacognitive skills can be expressed from learning process in abstract concepts including biology (Diella & Ardiansyah, 2017). Thus, metacognitive skills, self-regulated learning and learning motivation will be able to help students in understanding biological materials so that learning objectives can be achieved.

Research on the relationship between self-regulated learning and learning motivation with metacognitive skills which was analyzed simultaneously has not been much studied further, especially in Biology learning. The analysis of the relationships of the three variables is still fixated on the interrelationship between the two variables which are done separately. For examples research on the relationship of self-regulated learning with learning motivation or learning motivation with metacognitive skills. Therefore, it is possible to investigate the relationship between self-regulated learning and learning motivation with metacognitive skills simultaneously. This was conveyed in the study of Oguz and Ataseven (2016) that for subsequent studies, students' metacognitive skills and motivation can be investigated with different variables such as self-regulation, self-efficacy, problem solving skills, and reflective thinking.

Based on this background, the authors suspect there is a positive relationship between self-regulated learning and learning motivation with metacognitive skills and there is a contribution from self-regulated learning and learning motivation to metacognitive skills.

METHOD

The descriptive method was used as the method of study thru a quantitative approach using correlational technique. The study was conducted in May 2020. This study consisted of three variables that would be investigated, namely self-regulated learning, learning motivation, and metacognitive skill. The dependent variable

is metacognitive skill; meanwhile self-regulated learning and learning motivation are independent variables. The population in this study was a total of 177 students of class XI MIPA 1 – XI MIPA 5 SMAN 1 Tasikmalaya in the academic year of 2019/2020. Most of the students from the population in this study had almost the same learning abilities and characterize. Based on these characteristics, the samples were selected using Simple Random Sampling technique. Forty-three (43) students were then selected as the samples.

The instrument used in this study is the Metacognitive Awareness Inventory (MAI) adapted from Schraw and Dennison (1994) and the Motivated Strategies for Learning Questionnaire (MSLQ) adapted from Pintrich and De Groot (1990). In the MAI questionnaire, the number of statements used in this study was 41 statements after testing its validity and reliability. Each statement is filled out using a Likert scale of 1 to 4 with details of strongly agree, agree, disagree, and strongly disagree. As for the MSLQ questionnaire which is a validated instrument consist of 44 statements with each statement filled using a Likert scale of 1 to 5 with details of strongly agree, agree, disagree, disagree, and strongly disagree. The questionnaire was divided into two parts, namely concerning motivational beliefs to assess learning motivation with 22 statements; and regarding strategic self-regulated learning to assess self-regulated learning as many as 22 statements. This study used data analysis techniques involved of prerequisite test of data analysis and hypothesis test. The hypothesis test used is multiple linear regression tests. Before testing the hypothesis, the data obtained has been previously tested with normality and linearity test as a prerequisite for analysis.

RESULTS AND DISCUSSION

Based on the results of study, it was known that the three variables (self-regulated learning, learning motivation, and metacognitive skill) had a mean score for each of them, namely 84,51, 85,65, and 131,44. The highest score of self-regulated learning was 101, for learning motivation was 106 and metacognitive skill was 156. The lowest of self-regulated learning was 59, for learning motivation was 65 and metacognitive skill was 104. The score of self-regulated learning had a score difference of 42, learning motivation had a difference of 41, and the score of metacognitive skill had a score difference of 52 (Table 1).

Table 1. Research descriptive statistics

	Self-Regulated Learning	Learning Motivation	Metacognitive Skill
Samples	43	43	43
Maximum Score	101	106	156
Minimum Score	59	65	104
Standard Deviation	9,272	8,286	11,792
Mean	84,51	85,65	131,44

According to the data of study, the students who had a score of self-regulated learning above the average were 23 respondents (53,5%) and 20 respondents (46,5%) got a score below the average. This result was obtained after conducting an assessment on indicators of self-regulated learning i.e. the students' skills in cognitive strategy use and self-regulation. The students who had the learning motivation score above the average were 23 respondents (53,5%) and 20 respondents (46,5%) were still below the average score. This result was gained after conducting an assessment to the students including i.e. self-efficacy, intrinsic value, and test anxiety. The metacognitive skill results indicated that the students who had a score above the average were 23 respondents (53,5%) and there were 20 respondents (46,5%) who still got a score below the average score. This result was obtained after conducting an assessment on several indicators of metacognitive i.e. knowledge about cognition such as declarative knowledge, procedural knowledge, and conditional knowledge; and regulation of cognition such as planning, information management strategies, comprehension monitoring, debugging strategies, and evaluation.

The results of the normality test used Kolmogorov-Smirnov test indicated that the three groups of self-regulated learning, learning motivation, and metacognitive skill data were normally distributed. The linearity test results indicated that the data was linear.

In the hypothesis test of the relationship between self-regulated learning and learning motivation with metacognitive skill, the regression model test used was a multiple linear regression tests using software SPSS 25 for windows shown in Table 2.

Based on the multiple linear regression test (Table 2), the score of $p < \alpha$ (0.05). It could be inferred that the relationship between self-regulated learning and learning motivation with metacognitive skills. In addition, it is known that the correlation coefficient (R) is 0.747. This means that there is a strong relationship between self-regulated learning and learning motivation with metacognitive skills. Meanwhile, the coefficient of determination (R^2) is found to be 0.558 or 55.8%. This shows that self-regulated learning and learning motivation contribute

55.8% to metacognitive skills. While the remaining 44.2% is the influence of other variables not examined in this study.

Table 2. Summary of multiple linear regression results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Statistics				
					R Square	F	df1	df2	Sig.
1	0,747	0,558	0,536	8,033	0,558	25,255	2	40	0,000

The next analysis is the ANOVA test to determine the relationship of independent variables, namely self-regulated learning and learning motivation with the dependent variable, namely metacognitive skills simultaneously. A summary of the ANOVA test is presented in Table 3.

Table 3. Summary of ANOVA test

Model	Sum of squares	df	Mean square	F	Sig.
Regression	3259,403	2	1629,701	25,255	0,000
Residual	2581,202	40	64,530		
Total	5840,605	42			

The ANOVA test result in Table 3 shows that self-regulated learning and learning motivation simultaneously have a relationship with metacognitive skills. This is indicated by the significance value (sig.) of 0.000 which is smaller than the value of α 0.05 (significance < 0.05).

Further explanation about the regression equation is presented in Table 4. Table 4 shows the regression equation that is $Y = a + bx_1 + bx_2$. The value is 42.733, b value for x_1 is 0.351, and b value for x_2 is 0.694 so that the regression equation obtained is $Y = 42.733 + 0.351x_1 + 0.694x_2$. Table 4 also shows that partially it is only self-regulated learning that has a significant relationship with metacognitive skills.

Table 4. Summary of T-Test

Model	Unstandardized coefficients		Standardized coefficients	T	Sig.
	B	Std. Error	Beta		
(Constans)	42,733	13,147		3,250	0,02
Learning Motivation	0,351	0,223	0,247	1,575	0,123
Self-Regulated Learning	0,694	0,199	0,546	3,482	0,01

According to the results of the analysis that has been done, it can be concluded that there is a relationship between self-regulated learning and learning motivation and metacognitive skills. According to the results of the analysis that has been done, it can be concluded that there is a relationship between self-regulated learning and learning motivation and metacognitive skills. The results of the analysis are in line with the previous studies which stated that there is a significant positive relationship between metacognitive with self-regulated learning (Cera et al., 2013; Çetin, 2017; Pitriani et al., 2016; Sadati & Simin, 2017) and motivation (Bahri & Corebima, 2015; Lai, 2011a, 2011b; Landine & Stewart, 1998; Schraw et al., 2006; Yunanti, 2016). Self-regulated learning and motivation help students approach their learning tasks with the skills and attitudes that drive academic success (Landine & Stewart, 1998). It is because the higher self-regulated students have, the higher his or her metacognitive skills (Pitriani et al., 2016). As well as motivation, students who have high motivation will tend to use high metacognitive strategies to complete the tasks (Lai, 2011b; Pintrich & de Groot, 1990).

Self-regulated learning in relation to metacognitive skills is determined by its component parts. Both are included to measure the extent to which individuals are metacognitive, motivated, and actively participating in their learning process (Çetin, 2017). Regarding the metacognitive process, self-regulated learning uses various strategies such as planning, organizing, monitoring and self-evaluation during the learning process (Pintrich & de Groot, 1990; Sadati & Simin, 2017; Schraw et al., 2006). Metacognitive skills can be interpreted as a regulatory activity relating to problem solving that includes metacognitive planning, monitoring, and evaluation (Mustofa, Corebima, et al., 2019). Zimmerman (as cited in Williamson, 2015) labeled metacognitive in relation to self-regulated learning as the ability of learners to think consciously of their cognitive and have control over their cognitive processes. Based on this, a well-developed self-regulated learning will provide the learners the ability to direct their learning experience to be more active in a variety of ways (Sadati & Simin, 2017).

In the following discussion, learning motivation in relation to metacognitive skills refers to efforts to implement strategies in certain learning (Bahri & Corebima, 2015). It can be shown that students who have high learning motivation tend to have metacognitive strategies and will maintain their strategy in completing the given task compared to those who have low learning motivation (Bahri & Corebima, 2015; Pintrich & de Groot, 1990). If students' learning motivation is low, they cannot make efforts to determine their learning goals, choose and use methods, techniques, and strategies, or evaluate learning (Oguz & Ataseven, 2016). Students who have high learning motivation will pay close attention to the lesson, read the material so they can understand the content, and use a variety of supportive learning strategies. In addition, these students will also be involved in learning activities, have curiosity, find relevant resources to understand certain topics, and complete the assignments given (Bahri & Corebima, 2015). Referring to this, motivation in a metacognitive context is defined as beliefs and attitudes that influence the use and the development of cognitive and metacognitive skills (Lai, 2011a, 2011b; Schraw et al., 2006). In another sense, motivation explains the reasons why people do certain things, makes them continue to do it, and helps them to complete tasks (Bahri & Corebima, 2015). Motivation can arise from intrinsic factors and extrinsic factors (Bahri & Corebima, 2015; Lai, 2011b; Mubeen & Reid, 2015; Oguz & Ataseven, 2016; Pintrich & de Groot, 1990; Williamson, 2015). Intrinsic factors are the individual's interest in the subject being studied and orientation to take classes, while extrinsic factors are related to the instructor, the severity of the course, learning methods, and other conditions and facilities (Bahri & Corebima, 2015). The results of Tas et al. (as cited in Bahri & Corebima, 2015) show that intrinsic factors have a significant relationship with metacognitive. Traditionally, educators consider intrinsic motivation to be more desirable and produce better learning than extrinsic motivation (Lai, 2011b). In other words, the motivation of students to learn is one way to develop metacognitive skills and one of the factors for success in learning (Oguz & Ataseven, 2016).

CONCLUSION

Based on the results of this research, it can be concluded that there is a strong relationship between self-regulated learning and learning motivation with metacognitive skills. Self-regulated learning and learning motivation have a sizeable contribution to metacognitive skills. However, a deeper study and investigation should be conducted on the analysis of the relationship of these three variables by using instruments from other studies completed by the use of a larger number of samples.

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