UNIVERSITAS SEBELAS MARET
BIOEDUKASI: JURNAL PENDIDIKAN BIOLOGI
https://jurnal.uns.ac.id/bioedukasi
1693-265X (Print) | 2549-0605 (Online)

The Relationship Between Self-Regulated Learning and Higher-Order Thinking Skills on Musculoskeletal System Topics

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Submission : 08/04/2021.

Revision : 07/08/2021.

Accepted : 28/02/2022.

ABSTRACT

The student-centered learning process requires self-regulated learning to optimize the learning process that helps achieve learning objectives. This study aimed to investigate the correlation between self-regulated learning with students' high-order thinking skills on musculoskeletal system topics. This was descriptive research with a correlational method on 106 students. The data were analyzed with simple regression and correlation tests. The results show a correlation coefficient of 0.438. It indicates a positive correlation between self-regulated learning and students' higher-order thinking skills in musculoskeletal system topics. It indicates that higher self-regulation means better students' higher-order thinking skills. The coefficient determination result of 0.19 indicates that self-regulated learning contributes 19% to higher-order thinking skills and 81% is supported by other factors. It was recommended for further research to have better data collecting method and observing directly through video conferencing to reduce bias.

Keywords: Higher-Order Thinking Skills, Self-Regulated Learning, Biology.

Introduction

Indonesia is currently implementing the 2013 Curriculum. This curriculum is implemented to improve students' higher-order thinking, scientific, reading, and math skills. These skills are measured in the Program for International Student Assessment (PISA) international survey. PISA results can be used as a benchmark for the student's higher-order thinking skills. Results of the 2018 PISA showed that Indonesian students' skills in science, reading, and math were below average (Organization for Economic Cooperation Development, 2019). This occurs because students are not familiar with questions at that level (Hadi, et.al. 2018). One cause is teachers' lack of understanding regarding the 2013 Curriculum, and the difficulty in applying the scientific approach so that the objectives of the curriculum have not been achieved (Sudarisman, 2015).

The scientific approach is in learning, especially in science subjects such as Biology. Learning Biology applies scientific methods, such as formulating hypotheses, planning research, or making conclusions that include higher-order thinking skills (Zohar & Dori, 2003). It shows that learning Biology requires higher-order thinking skills. Meanwhile, the results of PISA show that Indonesian students' scientific thinking skills are still low. Most Biology teachers have not implemented the 2013 Curriculum learning optimally, thus the objectives to develop higher-order thinking skills have not been achieved (Isti'farin, et.al. 2016).

Higher order thinking skills can be defined as the ability to apply understanding at the highest level in Bloom's cognitive dimensions taxonomy as revised by Anderson and Krathwohl (2001): (C4), evaluation (C5), and creation (C6). Higher order thinking skills are characterized by the ability to relate the learned concepts in different contexts (Brookhart, 2010). One way to achieve higher-order thinking skills is using curriculum that prioritizes understanding scientific concepts in everyday life (Saido, et.al. 2015). Teachers should carry out learning and assessments that encourage students to have higher-order thinking skills (Suryawati & Suzanti, 2018).

Indonesian 2013 Curriculum places students at the center of the learning process (student-centered). This curriculum asks students to be independent in the learning process, not only as passive recipients of information from teachers (Ministry of Education and Culture, 2017). This appeal causes each student to be more active in various ways, including managing their learning strategies. Therefore, students need self-regulation in learning. Students must independently move and maintain cognitions, feelings, and behaviors systematically to achieve learning goals (Zimmerman & Schunk, 2011). Self-regulation in learning can make students active in determining information independently (Pintrich, 2000). Student-centered learning is carried out with various learning models, such as the cooperative learning model (Nurdyansyah & Fahyuni, 2016).

Various research and observations show that learning focus has a positive relationship with self-regulation in learning (Jung, 2013). Low self-regulation in learning makes students less interested, makes it difficult to control their desires, and creates conducive learning environments (Theresya, et.al. 2018). Thus, self-regulation is important in the learning process. Self-regulation enables students to set specific and proper learning goals, guides them to choose proper learning strategies, monitors the learning process independently, and encourages positive attitudes to support learning outcomes. Students with good self-regulation are expected to have good abilities to achieve learning goals through continuous self-assessment (Cheng, 2011).

Those descriptions underline the importance of self-regulation in learning and implementation of the 2013 Curriculum. The 2013 Curriculum is expected to develop higher order, following the demands of global education. Therefore, this study was conducted to determine the relationship between self-regulation in learning and students' higher-order thinking skills in learning musculoskeletal systems. This research is expected to uncover the

importance of self-regulation in learning and its effect on higher-order thinking skills. This research is also expected to provide information about the relationship between self-regulation and students' higher-order thinking skills in Biology learning and become a reference for further research.

Methods

This is descriptive correlational research with simple correlation regression analysis. This research was conducted at one Public High School in Jakarta during the 2020/2021 academic year. The sample was 106 eleventh graders selected with a multistage sampling technique. The research design is shown in Figure 1.

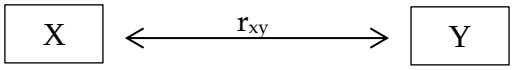

Figure 1. Research Design

Notations:
X = Self-regulation in learning.
Y = HOTS
r_{xy} = Coefficient of correlation between X and

The data were collected using a questionnaire and test with multiple-choice questions and short entries. The items were made from indicators of the Basic Competency 3.5 (locomotion system) with cognitive dimensions of higher-order thinking skills in the revised Bloom's taxonomy (analysis (C4), evaluation (C5), and creations (C6)) (Brookhart, 2010).

The self-regulation questionnaire was developed from indicators based on four dimensions of self-regulation with fifteen factors as proposed by Erdogan and Senemoglu (2016). Statements on the self-regulation questionnaire consisted of positive and negative statements. The Likert scale was used with the following scoring: (5) always, (4) often, (3) sometimes, (2) rarely, and (1) never for positive statements. For negative statements, the scoring was: (1) always, (2) often, (3) sometimes, (4) rarely, and (5) never.

The data were analyzed using regression and correlation analysis. The analysis begins with the normality test using the Kolmogorov Smirnov, and the homogeneity test using the Bartlett test. The regression test used simple linear regression analysis and continued with the regression linearity test. Finally, a simple Pearson Product Moment test was performed with a correlation coefficient of= 0.05.

Results and Discussions

The results showed that 65 students (61%) got the high category, 25 students (24%) got medium results, and 16 people (15%) got low. The results are summarized in Figure 2 below.

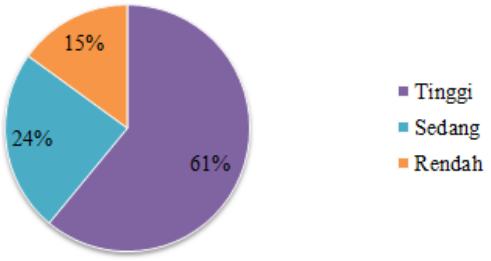

Figure 2. Categorization of Students' HOTS

The average score of students' thinking skills is 66.75. It indicates means that students have good higher order thinking skills. This is because the students came from high-rank high schools. Based on the results of the 2019 National Examination scores, especially in Biology, this school (HS1) was ranked 19 out of 117 in Jakarta (Ministry of Education and Culture, 2019). Lissa, et.al. (2012) stated that higher-order thinking skills have a positive influence on the achievement of learning outcomes. Therefore, a good National Examination score indicates a high achievement of learning outcomes, so that students have good higher-order thinking skills. The results show that C6 has the highest percentage of achievement (69%), followed by C4 (67%), and then C5 (43%). The student's cognitive level achievement is shown in Figure 3.

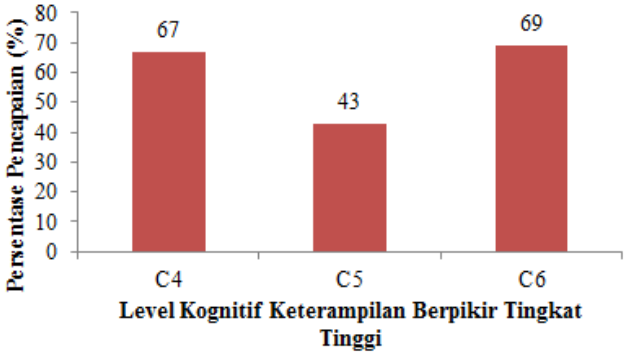

Figure 3. Gains of Students' HOTS Levels

The results indicate that students have good skills at the C4 and C6 cognitive levels, but not at the C5. Prasetyani, et.al. (2016) said that students with good C4 and C6 skills can parse information, use concepts, analyze problems, determine steps to solve problems and determine initial ideas. The students who had poor C5 skills are less able to assess, support, refute arguments, and write conclusions correctly. These results are in accordance with Saido et al. (2015), which suggested that most students are poor level at evaluation skills. Purnamaningrum, et.al. (2012) said that learning in secondary schools has not maximized students' higher-order thinking skills.

The low mastery of the C5 cognitive level indicates the need to improve students' evaluation abilities. Higher order thinking skills can be improved through the proper learning environment and learning process (Heong et al., 2012). One of them is by applying a problem-based learning model. In addition, Prasetyani et al. (2016), and Kurniawan & Lestari (2019), stated that teachers can familiarize students with solving problems, using or making their own teaching materials that can train students higher-order thinking skills, and use questioning strategies. Learning with peer assessment also can improve higher-order thinking skills. With this method, students will learn to explore, analyze, and evaluate the work of their friends (Hadzhikoleva, et.al. 2019).

Biology learning requires high-order thinking skills. It is because the scientific thinking process is required in decision-making, especially when identifying problems as the first step of problem-solving. Problem analysis is needed for finding the solutions. Higher-order thinking skills are also needed to assist students in completing assignments and learning lessons (Heong et al., 2012). Therefore, students' higher-order thinking needs to be improved to support Biology learning.

The results also show that in self-regulation, 58 students (55%) have the high level, and one student has the lowest level. The students' self-regulation categories are shown in Figure 4:

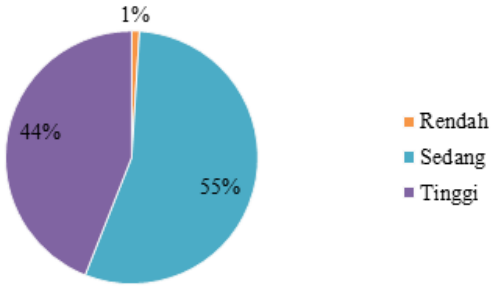

Figure 4. Kategori Nilai Regulasi Diri dalam Belajar

The average score of students' self-regulation is 70.93 (medium). The students' self-regulation was suboptimal because students have not been trained to carry out self-regulation in learning. Students still dependent on teachers (Jumaisyaroh et.al. 2014). As stated by Theresya et.al. (2018, adolescents' self-regulation, including high school students, was in the medium category.

Online learning requires students to be independent. Wong et al. (2019) stated that self-regulation helps students in online learning. Zhu et.al. (2016) stated that students with low levels of self-regulation will have greater difficulty completing tasks during online learning. The teacher respondents also said that they have difficulty directing students during online learning.

The results show that the aspect of post-learning has the highest gain of 73%, followed by motivation (72%), and the strategy before and during learning has the lowest percentage (71%). The gains of each aspect in self-regulation are shown in Figure 5.

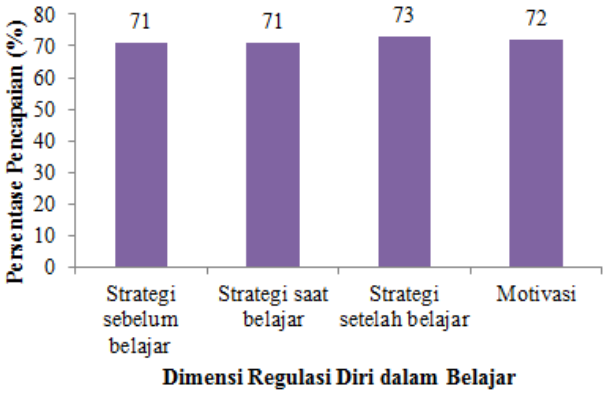

Figure 5. Gains in Self-Regulation during Learning

Each aspect of self-regulation has a small difference in gain and tends to be in the medium category. Barnard-Brak et.al. (2010) stated that most students apply self-regulation in learning irregularly, whereas, all aspects of self-regulation are interrelated and influences each other. Therefore, students need direction to apply all aspects of self-regulation in learning regularly, thus maximizing the learning outcomes.

Relationship of Self-Regulation in Learning with Students' Higher Order Thinking Ability

The results of the significance test show that the F-count is greater than the F-table at = 0.05, which is 24.747> 3.932. It means H0 is rejected. The model and the regression equation are significant and produce a regression equation of= -16.716 + 1.177X for self-regulation in learning (X) and higher-order thinking skills (Y). The equation shows that for every addition of one self-regulation value, the students' HOTS is increased by 1.177. The results of the linearity test show that the F-count is smaller than the F-table at = 0.05, which is 1.159 <4.139.

Thus, H0 is accepted, and there is a linear relationship between the two variables. The distribution of the equation data is shown in Figure 5.

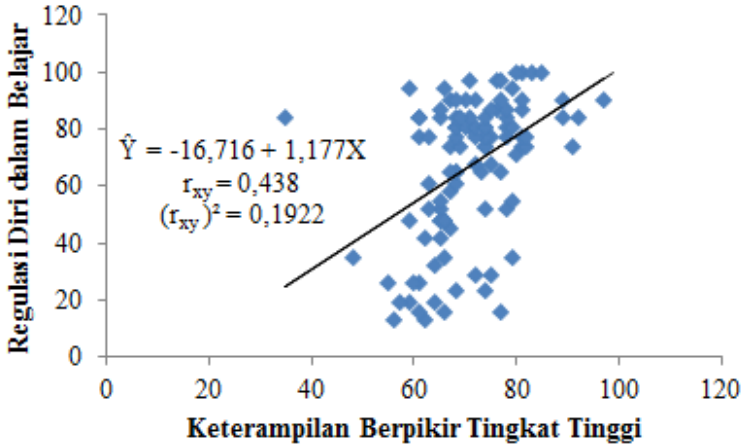

Figure 6. Regression Model for Self-Regulation in Learning with Higher Order Thinking Skills

The test results show that self-regulation in learning has a positive relationship with higher-order thinking skills. The coefficient of correlation of 0.438 indicates that self-regulation in learning has a fairly strong relationship with higher-order thinking skills. Therefore, the higher the self-regulation in learning, the HOTS will be. Self-regulation in learning makes the learning process more optimal and effective so that learning objectives can be achieved (Wong et al., 2019). The development of higher-order thinking skills is objective of science learning. Higher-order thinking skills also include cognitive learning outcomes at the highest level, so students who get good learning outcomes will have good higher-order thinking skills (Saido et al., 2015). The application of self-regulation such as organizing, analyzing, and synthesizing information, as well as managing study time, environment, and effort is also the application of higher-order thinking skills (Zhu et al., 2016). Therefore, higher-order thinking skills will encourage students to apply self-regulation in learning (Wong et al., 2019).

The coefficient of determination is 0.19, which means that self-regulation in learning contributes 19% to higher-order thinking skills, while 81% is caused by other factors. Nisa and Wasis (2018) stated that higher-order thinking skills are affected by students' cognitive development and the teachers' teaching strategies. Therefore, to develop self-regulation, teachers can implement a learning process that triggers the development of thinking processes.

Conclusions

It can be concluded that there is a positive relationship between self-regulation and students' higher-order thinking skills. Future research should conduct data retrieval remotely (online) with a certain time limit, and direct observations should be accompanied by video recording to reduce bias.

Acknowledgements

Thanks for all participants and stakeholders whose help this study to be completed.

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