Biosfer: Jurnal Pendidikan Biologi

Journal homepage: http://journal.unj.ac.id/unj/index.php/biosfer

Fostering metacognitive skill: A means to improve students' academic achievement

Andini Maulida Rizkia, Zulfiani*

Biology Education, Faculty of Tarbiya and Teaching Science, Univeritas Islam Negeri Syarif Hidayatullah Jakarta, Indonesia

*Corresponding author: zulfiani@uinjkt.ac.id

ARTICLE INFO

Article history
Received: 13 Februry 2021
Revised: 16 July 2021
Accepted: 27 July 2021

Keywords:
Academic achievment
Biology
Metacognitive skills

ABSTRACT

Metacognition is one of five key learning skills in the 21st century. This research aims to describe the profile of students' metacognitive skills in biology learning at Tangerang Selatan Senior High School. This type of research was survey with descriptive approach. The population of this research was students of Senior High school in Tangerang Selatan, Indonesia. Sampling was conducted with stratified sampling, four school was determined by random sampling. Data on metacognitive skills were collected using questionnaires with supporting data in the form of interviews, observations, and documentation. The survey results of metacognitive skills and observation were analyzed using descriptive statistics. Based on the results of the survey, the average planning result is 72.47%, monitoring by 73%, and evaluating by 72.17%. The results showed that students' metacognitive skills in biology are in a strong category so that these skills can support the increase students' academic outcomes in the learning process.

Rizkia, A. M., & Zulfiani, Z. (2021). Fostering metacognitive skill: A means to improve students' academic achievement. *Biosfer: Jurnal Pendidikan Biologi, 14*(2), 275-284. https://doi.org/10.21009/biosferjpb.19839

INTRODUCTION

21st century Knowledge alone is not enough to prepare students to thrive in the world demand. Employers are talking about recent graduates who were lack of skills at work as they become employees. As to cope with the problem, students should have to learn what to do with the information they learn (Bialik & Fadel, 2015). The information they have learned is a form of self-reflection. Metacognitive skills enable students to reflect themselves throughout life to support processes of collaboration with others and adaptation (Lysaker et al., 2019) in a rapidly evolving information society (Hogan et al., 2015). Equipping students with thinking skills is the same as assembling students to survive in the future (Amin et al., 2020).

Metacognition was recently identified as one of the five key components for 21st-century learning (Global Partnership For Education, 2020). In simple terms, metacognition is thinking about thinking and is directly related to other four components: critical thinking, creativity, collaboration, and motivation (Lai & Viering, 2012). Metacognition is critical key of success in education and the world of work. Teachers cannot teach students everything they need to learn. However, they can prepare students to master learning strategies (O'brien, 2015). Good thinkers will use their strategies regularly to solve problems at hand and know when and where to use it.. (Santrock, 2004).

The strategies used by students can make it easier for them to learn concepts in biology lessons. Biology learning can help students learn to think from experience (Ristanto et al., 2020; Harahap et al., 2020). Promoting metacognition in students by teaching students to think about biology and how to study the subject (Tanner, 2012). Metacognition is very important in natural science lessons (Az-zahra, et al, 2021; Nurajizah et al., 2018). So that students are trained to solve a problem (Iskandar, 2014) because metacognitive skills can help students to plan, follow the learning and monitor the learning process (Ismirawati et al., 2020). In addition, in terms of communicating, self-controlling, remembering, solving problems, and developing personality, metacognitive abilities are related to the control of cognitive components that make students understand the tasks or problems they face (Paidi & Rachmawati, 2013). But students often do not understand and apply metacognitive skills (Dawood et al., 2018). Whereas students who have high metacognitive strategies will be easily taught with any learning model because these students can control, and monitor themselves in learning (Sastrawati et al., 2011). Metacognitive skills can improve student achievement (Abu Bakar & Ismail, 2020), improve student cognitive learning outcomes (Miharja et al., 2015) and increase student motivation (Oguz, 2016). So metacognitive skill can make it easier for students to face the 21st-century.

Many studies are relevant to this variable (Plennari et al., 2018; Sholihah et al., 2002; Ijirana, & Supriadi, 2018). However, there has been no research on metacognitive skill profiles in Tangerang Selatan Senior High School using the Metacognitive skill scale. Previous research at Tangerang Selatan High School has discussed metacognitive skills and their correlation using learning strategies (Zulfiani et al., 2020), but none has discussed the profile of metacognitive skills.

This study aims to look at the profile of students' metacognitive skills in learning biology at SMAN Tangerang Selatan, Indonesia. If the description of metacognitive skills at SMAN Tangerang Selatan is known, it is hoped that this research can be used as input for teachers as a follow-up to the learning process in the classroom, so that students can use metacognitive skills in the learning process.

METHODS

Research Design

This study was conducted in the 2019/2020 school year, which began on 27 August 2019 until 02 October 2019. The type of study used in this study is survey research with a quantitative descriptive approach.

Population and Samples

The population in this study was all XI class at Tangerang Selatan Senior High School or SMAN Tangerang Selatan, South Tangerang has 12 public schools. The sample selection was conducted with sampling strata using the results of the 2019 national exam on biological subjects. Subsequent random sampling to represent the school in each category (high-moderate-low). Therefore, there were four SMA Negeri Tangerang Selatan namely SMAN A, SMAN B, SMAN C and SMAN D Tangerang Selatan with a total of 266 respondents.

Instrument

The Data obtained from this research was Metacognitive skills of learners. The primary instrument of this research was a questionnaire that was adopted from the Altindagh Metacognitive skills questionnaire by using a Likert scale (Altindagh, 2013) and a secondary instrument that used, which refers to development indicators metacognitive skills (Zulfiani, Sillak, Yanti, Eny, Ghina, and Nila, 2018). The learning process observation data aims to look at the teacher's role in assisting learners to use metacognitive skills and interview data aimed at confirming observation data for teachers and skills questionnaire data For the learners. So obtained observation instruments learning process and instrument interview teachers and students. Before the research, the Metakognitiff skill questionnaire was validated at SMAN E South Tangerang. Validity test in this study using SPSS version 22 and acquired 28 statements of 30 items with the reliability of 0.733, It indicated that the data was valid to be use in research (Siregar, 2011).

Procedure

The research was conducted for two days in the fourth SMA Negeri South Tangerang. The first day of observation was performed and the second day is a student and teacher interview. Observation was one meeting conducted in one class in each high school of South Tangerang, observation was done to see the learning process which was taken place by filling the observation sheet of the learning process. Observations focused on metacognitive skills (planning-monitoring-evaluation) in the classroom carried out by the teacher.

On the second day students' and biology subjects ' teachers interview were performed. The student interviews of each SMA were conducted randomly in the category (High-medium-low) to 2 males and 2 females with the number of respondents interviewed at the fourth high school in Tangerang Selatan, which is 16 respondents. The student interviews about metacognitive skill (planning-monitoring and evaluation). Teacher interviews are conducted as confirmation of observation data during the learning process about planning, monitoring and evaluation carried out by teacher.

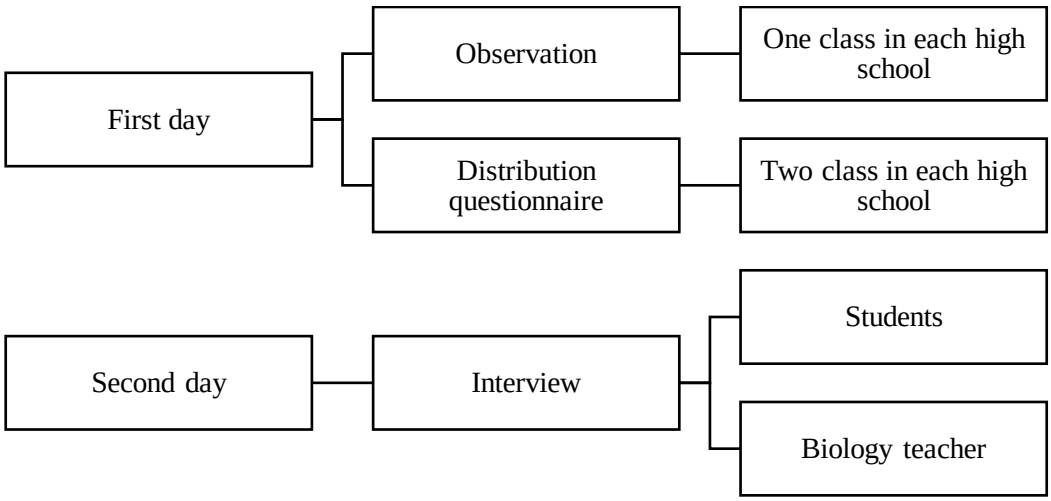

Figure 1. Research Procedure

Data Analysis Techniques

Data analysis techniques include quantitative data and qualitative data. The results of the metacognitive skills questionnaire data are categorized using the score interpretation criteria as in Table 1.

Table 1

Score Interpretation criteria

Criteria (%)	Information
0 - 20	Weak
21 - 40	Very Weak
41 - 60	Fair
61- 80	Strong
81 - 100	Very Strong

(Riduwan, 2012)

Qualitative data includes the teacher and student interview data that is being tested from the recording tool which is then described in each of the fourth high schools in Tangerang Selatan.

RESULTS AND DISCUSSION

Data on the students' metacognitive skills were obtained from the results of metacognitive skills questionnaire from Altindagh with 266 respondents at SMAN Tangerang Selatan. The results of metacognitive skills questionnaire data in planning, monitoring, and evaluating can be seen in Table 2 and Figure 1 below:

Table 2

Description of Metakognitive skills at SMAN Tangerang Selatan

School	Frequency	Planning (%)	Monitoring (%)	Evaluating (%)
SMAN A	62	68.70	69.11	67.93
SMAN B	69	72.07	73.29	72.40
SMAN C	65	72.92	73.07	72.12
SMAN D	70	76.17	76.53	76.22
Total	**266**	**72.47**	**73.00**	**72.17**

The following diagram shows an overview of the four schools based on the percentage of the results on metacognitive questionnaire as presented in Figure 1. Based on the result of Figure 1 that the picture of the plot shows planning, monitoring, and evaluating that are not much different in each high school. The average of the indicators of metacognitive skills is concluded into the category of metacognitive skills that are very weak, weak, fair, strong, and very strong. And all of Senior High School in category strong. Students with high metacognition and self-regulation who are actively involved in their learning process plan and integrate the tasks they focus on (Abu-ameerh, 2014). Conclusion Categorization of questionnaire results is presented in Table 3.

Based on Table 1 in the planning aspects, the average results of the questionnaire Metacognitive skills of the fourth SMAN in South Tangerang is 72.47%, this acquisition is in the category of strong. Students with high category interviewed already have a proven strategy with all the answers students answered have had a strategy while studying biology. While in the medium category, three learners admitted that they did not have a strategy while studying biology. Planning is the selection of strategies and the allocation of resources. Examples include making predictions before reading, sequencing strategies, and allocating time and planning before starting a task. (Rathore & Sonawat, 2015).

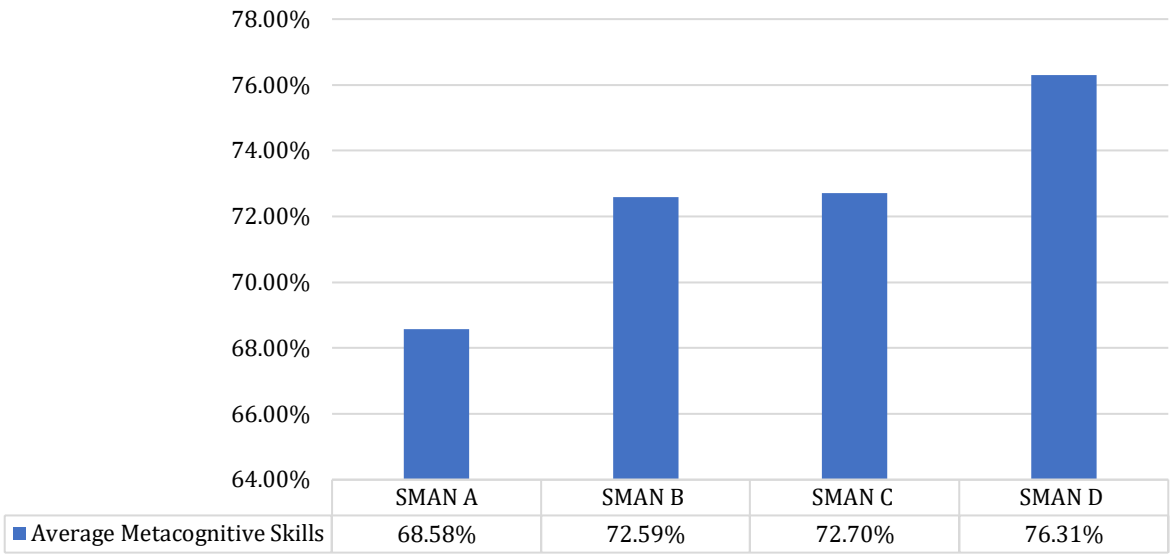

Figure 1. Description of Metakognitive skills at SMA Negeri Tangerang Selatan

Table 3
Categorization results Questionnaire Metacognitive skills

School	Frequency	Average (%)	Criteria
SMAN A Tangerang Selatan	62	69	Strong
SMAN B Tangerang Selatan	69	73	Strong
SMAN C Tangerang Selatan	65	73	Strong
SMAN D Tangerang Selatan	70	76	Strong

Based on the observation data in the Planning section, teachers help students achieve their learning objectives by mentioning the reference or information needed during the learning process. Previously, teachers also helped students to learn the objectives of biological materials being studied. Planning ability is also one of the metacognitive skills related to the preparation of learning activity plans (Yasir, et al, 2020). So when learners know the learning objectives that are being studied, it will bring motivation to the goal of achieving that learning objective.

The second aspect is monitoring, the average results of the questionnaire metacognitive skills in SMAN Tangerang Selatan is 73% with strong categories. Based on the interview data of 7 out of 8 learners are in the high category answering the relation between one material and other material. While the 2 students of the category are answering there is no relation between one material with other material on biological learning and 2 others answer there is a relation but are not yet able to answer the example of material linkage in biology. Learners who are conscious of the material interconnectedness with each other using the experience of the learning process. Learners are faced with problems, in which case learners begin to study. These conditions include stimuli in the students' Metacognitive experiences (Zulfiani, Sillak, Eny, Ghina, & Nila, 2018). In the next statement, 15 out of 16 learners are aware of the difficulties faced when studying biological material and students answering can overcome the difficulties in biological material. Students who respond with "I understand now" or "I don't understand" mean that students can monitor and regulate their cognitive achievement (Annervita & Vauran, 2006). So when being interviewed, learners who already have a way to overcome the difficulties faced by unconsciously have used the activities of the monitoring.

Based on observation data, teachers have helped students to conduct monitoring activities by conducting discussions in the classroom, so students can confirm their understanding during the learning process. How student practiced in the classroom allowing

them to use a metacognitive strategy at the stages of a given task. This ensures that learners increase self-awareness and the ability to choose effective thought processes in the future. During planning the teacher must think hard so that students can follow the demonstration of the thinking process. Adding some other indicators of metacognition that teachers can do might be sharing their plans, describing goals and objectives, giving reasons for their actions, seeking feedback and evaluation (Papleontiou-Louca, 2003).

The third aspect is evaluating, the average result of the evaluating part of the questionnaire is 72.17% of strong categories. Based on interviews, almost all learners can evaluate the extent of the material being understood. Only one learner who replied has not evaluated the extent of the material being understood. Evaluation involves reflections on how well learners fulfill the learning objectives after completing a study unit or receiving feedback such as tests or assignments (Kwantlen Polytechnic University Learning Centres, 2018). So in evaluating activities, learners will examine the suitability between what is known with what steps are used to solve the problem. Learners can ask themselves how well they are solving problems based on previous knowledge (Adnan & Bahri, 2018).

Based on teacher observation data revealed that students evaluate how much material is understood through post-test and confirm their understanding through the discussion and question and answer activities that are further concluded at the end of the material or meeting. Teachers have already done the discussion because of improving Metacognitive skills, it will be easier to do with the discussion activities. Learners need to understand the cognitive thinking skills applied in metacognitive skills by discussing to complement each other's knowledge of learners (Nafilah & Azizah, 2015). Discussions can expand students' knowledge and teachers can develop reflective classes where students build new knowledge and learn to manage their learning with teacher guidance in discussion classes (Fisher, Yaniati & Kusumah, 2017). So that student discussions can confirm understanding and evaluate learning outcomes. In addition of a Post-test ,teacher can help learners to gauge the extent of the material they learn.

All three aspects of this metacognitive skill are closely related each other, such as planning can be interpreted as a regulatory action to determine the objectives, monitoring the performance assess the process by adjusting to the objectives and Evaluating is assessing the outcome of performance by reassociating the objectives (Zulfiani, et al., 2018). Metacognitive skills refer to awareness control processes such as planning, monitoring progress of processing, allocation, use strategies, and regulation of cognition (Papleontiou-Louca., 2003).

Based on data from the results of the metacognitive skills questionnaire that no student in the low category signifies the metacognition skills of SMAN Tangerang Selatan in a strong category. Metacognitive skills at SMAN Tagerang Selatan are already in a strong category so that using any learning model in the classroom will be easier to teach (Sastrawati, 2011) learning strategies that can be used include Inquiry (Nunaki, 2019), Guide inquiry (Hastuti, 2020), Lesson Study (Lukitasari, 2014), etc. What has been researched at SMAN Tangerang Selatan is using PBL Combine Question Student Have and journal (Zulfiani, et al, 2020). Based on the results of interviews with teachers and the observation of the document SMAN A, B, C, and D that teachers unconsciously help students to use their skills in class with cognitive active learning. Based on data Figure 1, SMAN A's average is smaller than the other three schools because students may not know their weaknesses and strengths and to increase metacognitive skills. During the interview, the teacher answered that they still did not understand what metacognition was. So it is better for teachers to understand metacognitive so that they can integrate learning strategies with metacognitive skills. Based on research Öz (2016) states that metacognitive awareness can improve performance among teachers, so this is related to motivation which will affect academic achievement. Further, based on the results of the study of (Indana, 2009) that the ability of metacognition has not been intentionally empowered in the learning process. Causing many learners facing difficulty learning because the teacher is

unaware that this can affect the learning process of learners. If this is not well addressed, learners can experience difficulties at a higher level of education. Teachers can help introduce learners to Metacognitive skills on biological learning in four ways based on the research of (Tanner, 2012), namely Pre-assessments, The muddiest Point, Retrospective Post assessments, and Reflective Journals. Ultimately, metacognitive requires learners to "externalize mental events" as to what it means to learn, awareness about the strengths and weaknesses of learners in the context of learning, what plans are needed to achieve goals or Specific learning activities, identifying and correcting mistakes and preparing for the learning process (National Research Council 2000).

CONCLUSION

Based on the results of the survey it can be concluded that students ' metacognitive skills are generally in strong categories, which means students are aware of their strengths and weaknesses as students. Based on the results of the student metacognitive questionnaire, SMAN A South Tangerang received an average acquisition of 69%, SMAN B Tangerang Selatan and SMAN C Tangerang Selatan received an average yield of 73% and SMAN D Tangerang Selatan received An average yield of 76%. Overall, the average of the third aspect of metacognitive skills is planning at 72.47%, monitoring at 73%, and evaluating by 72.17%. While based on the observation results, 80-100% of teachers have helped students to use their metacognitive skills in all three aspects, namely planning, monitoring, and evaluating. Metacognitive Skills research in the form of prospective to describe metacognitive skills at SMAN Tangerang Selatan. Therefore it can be concluded that SMAN in the South Tangerang area has had strong metacognitive skills both in planning, monitoring, and evaluation. So, schools and teachers have carried out the learning process with metacognitive skills.

ACKNOWLEDGMENT

This research was implemented in good cooperation and the author expresses gratitude to the various parties who have helped and supported the authors to complete this research.

REFERENCES

Abu Bakar, M. A., & Ismail, N. (2020). Exploring Students' Metacognitive Regulation Skills and Mathematics Achievement in Implementation of 21St Century Learning in Malaysia. *Problems of Education in the 21st Century, 78*(3), 314–327. https://doi.org/10.33225/pec/20.78.314

Abu-ameerh, O. A. (2014). Learning styles as a predictor of meta-cognition among undergraduate students at Albalaq ' an Applied University. *Canadian Social Science*, *10*(2), 62–66. https://doi.org/10.3968/4465

Adnan, & Bahri, A. (2018). Beyond effective teaching: Enhancing students' metacognitive skill through guided inquiry. *Journal of Physics: Conference Series, 954*. https://doi.org/10.1088/1742-6596/954/1/012022

Altinda, M. (2013). Metacognitive Skills Scale. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *28*(28–1), 15–26. https://www.researchgate.net/

Amin, A. M., Corebima, A. D., Zubaidah, S., & Mahanal, S. (2020). The correlation between metacognitive skills and critical thinking skills at the implementation of four different learning strategies in animal physiology lectures. *European Journal of Educational Research, 9*(1), 143–163. https://doi.org/10.12973/eu-jer.9.1.143

Annevirta, T., & Vauras, M. (2006). Developmental changes of metacognitive skill in elementary school children. *Journal of Experimental Education*, *74*(3), 195–226. https://doi.org/10.3200/JEXE.74.3.195-226

Az-zahra, R., Rusdi, R., & Ristanto, R. H. (2021). Metacognitive, Critical Thinking, and Concept Understanding of Motion Systems: XI MIPA Correlational Study. *Bioedukasi: Jurnal Pendidikan Biologi, 14(*2), 156-170. https://doi.org/10.20961/bioedukasi-uns.v14i2.52972

Bialik, M., Fadel, C., Trilling, B., Nilsson, P., & Groff, J. (2015). 21st Century Skills: What should students learn? May. https://curriculumredesign.org/wp-content/uploads/CCR-Skills_FINAL_June2015.pdf

Dawood, M., Trujillo, K., Wojahn, P., Guynn, M., Rangel, L., & Mahbub, S. M. Y. (2018). Board 35:Metacognition: Helping Students Plan, Monitor, and Evaluate Study Skills and Strategies. *ASEE Annual Conference & Exposition Proceedings*, 2018-June. https://doi.org/10.18260/1-2--30015

Fisher, D., Yaniawati, P., & Kusumah, Y. S. (2017). The use of CORE model by metacognitive skill approach in developing characters junior high school students. *AIP Conference Proceedings*, *1868*. https://doi.org/10.1063/1.4995137

Global Partnership For Education. (2020). *21st Century Skills: What potential role for the Global Partnership for Education? A Landscape Review*. *January*, 1–65. https://www.globalpartnership.org/content/21st-century-skills-what-potential-role-global-partnership-education

Harahap, L. J., Ristanto, R. H., & Komala, R. (2020). Getting critical thinking about ecosystem: How impact and responses of students about the CirGi learning model?. *Biosfer: Jurnal Pendidikan Biologi, 13*(1), 86-100. https://doi.org/10.21009/biosferjpb.v13n1.86-100

Hastuti, I. D., Surahmat, Sutarto, Dafik. (2020). The effect of guided inquiry learning in improving metacognitive skill of elementary school students. *International Journal of Instruction, 13(*4), 315–330. https://files.eric.ed.gov/fulltext/EJ1270820.pdf

Hogan, M. J., Dwyer, C. P., Harney, O. M., Noone, C., & Conway, R. J. (2015). Metacognitive skill development and applied systems science: A framework of metacognitive skills, self-regulatory functions, and real-world applications. *In Intelligent Systems Reference Library* (76). https://doi.org/10.1007/978-3-319-11062-2_4

Ijirana, & Supriadi. (2018). Metacognitive skill profiles of chemistry education students in solving a problem at a low ability level. *Jurnal Pendidikan IPA Indonesia, 7*(2), 239–245. https://doi.org/10.15294/jpii.v7i2.14266

Indana, S. (2009). Efektivitas Perangkat Pembelajaran Virus Dengan Strategi Metakognitif Terhadap Perolehan Kognitif Peserta didik SMA Kelas X. *Seminar Nasional Penelitian, Pendidikan, dan Penerapan MIPA*, B.326-331, https://eprints.uny.ac.id/

Iskandar, S. M. (2014). Pendekatan Keterampilan Metakognitif Dalam Pembelajaran Sains Di Kelas. *Erudio Journal of Educational Innovation, 2*(2), 13–20. https://doi.org/10.18551/erudio.2-2.3

Ismirawati, N., Corebima, A. D., Zubaidah, S., Ristanto, R. H., & Nuddin, A. (2020). Implementing core in learning: Will metacognitive skills correlate to cognitive learning results?. *Universal Journal of Educational Research, 8*(4), 51–58. https://doi.org/10.13189/ujer.2020.081808

Kwantlen Polytechnic University Learning Centres. (2018). University 101: Study, Strategize and Succeed. Surrey BC: Kwantlen Polytechnic University, 5. https://pressbooks.bccampus.ca/studystrategizesucceed/

Lai, E. R., & Viering, M. (2012). *Assessing 21st-century skills: integrating research findings*. Annual Meeting of the National Council on Measurement in Education, Vancouver, BC, Canada, April, 66. https://eric.ed.gov/

Lukitasari, M., Herawati, S., Ibrohim, Corebima, A.D. (2014). Lesson Study in Improving the Role of E-Portfolio on the Metacognitive Skill and Concept Comprehension: A Study on Cell Biology Subject in IKIP PGRI Madiun, Indonesia. *American Journal of Educational Research, 2*(10), 919–924. https://doi.org/10.12691/education-2-10-11

Lysaker, P. H., Kukla, M., Vohs, J. L., Schnakenberg Martin, A. M., Buck, K. D., & Hasson Ohayon, I. (2019). Metacognition and recovery in schizophrenia: From research to the development of metacognitive reflection and insight therapy. *Journal of Experimental Psychopathology, 10*(1). https://doi.org/10.1177/2043808718814992

Miharja, F. J., Hindun, I., & Fauzi, A. (2019). Critical thinking, metacognitive skills, and cognitive learning outcomes: a correlation study in genetic studies. *Biosfer: Jurnal Pendidikan Biologi*, *12*(2), 135–143. https://doi.org/10.21009/biosferjpb.v12n2.135-143

Nafilah, E., & Azizah,U. (2015). Keterampilan Metakognitif Peserta didik Melalui Model Pembelajaraan Kooperatif Tipe Numbered Heads Together (NHT) Pada Materi Kesetimbangan Kimia Di Kelas XI SMA Negeri 1 Sumenep. *UNESA Journal of Chemical Education, 4*(2), 204-211. https://jurnalmahasiswa.unesa.ac.id/

National Research Council (2000). *How People Learn: Brain, Mind, Experience, and School: Expanded Edition*. Washington, DC: The National Academies Press. https://doi.org/10.17226/9853

Nunaki, J. H., Damopolii, I., Kandowango, N. Y., Nusantari, E. (2019). The effectiveness of inquiry-based learning to train the students' metacognitive skills based on gender differences. *International Journal of Instruction*, *12*(2), 505–516. https://doi.org/10.29333/iji.2019.12232a

Nurajizah, U., Windyariani, S., & Setiono, S. (2018). Improving students' metacognitive awareness through implementing learning journals. *Jurnal Pendidikan Biologi Indonesia, 4*(2), 105–112. https://doi.org/10.22219/jpbi.v4i2.5788

O'brien, C. (2015). Metacognition and Learning to Learn. Retrieved from https://life.lfny.org/2015/12/05/metacognition-and-learning-to-learn

Oguz, A. (2016). The Relationship Between Metacognitive Skills and Motivation of University Students. *Educational Process: International Journal*, *5*(1), 54–64. https://doi.org/10.12973/edupij.2016.51.4

Öz, H. (2016) . Metacognitive Awareness and Academic Motivation: A CrossSectional Study in Teacher Education Context of Turkey. *Procedia - Social and Behavioral Sciences,* 109 – 121. https://doi.org/10.1016/j.sbspro.2016.10.035

Paidi, Wibowo, Y., & Rachmawati, A. (2013). Analisis Tingkat Kemampuan Metakognitif Mahasiswa Jurusan. *Seminar Nasional Pendidikan Biologi Dan Biologi*, Universitas Negeri Yogyakarta, 365–378.

Palennari, M., Taiyeb, M., & Saenab, S. (2018). Profile of Students' Metacognitive Skill Based on Their Learning Style. *Journal of Physics: Conference Series, 1028*(1). https://doi.org/10.1088/1742-6596/1028/1/012030

Papleontiou-Louca, E. (2003). The concept and instruction of metacognition. *Teacher Development*, *7*(1), 9–30. https://doi.org/10.1080/13664530300200184

Rathore, M. K., Sonawat R. (2015). Metacognition: A predictor of learning outcome. *The Indian journal of social work, 76*(4), 559-572.

Riduwan. (2012). *Belajar Mudah Penelitian untuk Guru-Karyawan dan Peneliti Muda*. Bandung: Alfabeta.

Ristanto, R. H., Miarsyah, M., Muharomah, D. R., Astuti, T. A., & Aini, S. Prihatin., AI (2019). Light-Board: simple media to learn photosynthesis concepts. *International Journal of Advanced Trends in Computer Science and Engineering,* *9*(1), 299-303. https://doi.org/10.30534/ijatcse/2020/45912020

Santrock, J. W. (2004). Psikologi Pendidikan. Jakarta, Indonesia: Prenamedia Group

Sastrawati, E., Rusdi, M., & Syamsurizal. (2011). Problem-Based Learning, Strategi Metakognisi dan Keterampilan Berpikir Tingkat Tinggi Siswa. *Tekno-Pedagogi, 1*(2), 1–14. https://online-journal.unja.ac.id

Sholihah, M., Zubaidah, S., & Mahanal, S. (2002). Keterampilan Metakognitif Peserta didik SMA Negeri Batu Pada Mata Pelajaran Biologi. Prosiding Seminar Nasional Biologi / IPA dan Pembelajarannya. *Prosiding Seminar Nasional Biologi / IPA dan Pembelajarannya*. October 2015, 1669–1676. https://www.researchgate.net/

Siregar S. (2011). *Statistika Deskriptif untuk Penelitian: Dilengkapi Perhitungan Manual dan Aplikasi SPSS versi 17*. Jakarta : Rajawali Pers.

Tanner, K. D. (2012). Promoting student metacognition. *CBE Life Sciences Education*, *11*(2), 113–120. https://doi.org/10.1187/cbe.12-03-0033

Yasir, M., Fikriyah, A., Qomaria, N., & Al Haq, A. T. (2020). Metacognitive skill on students of science education study program: Evaluation from answering biological questions. *JPBI (Jurnal Pendidikan Biologi Indonesia),* *6*(1), 157–164. https://doi.org/10.22219/jpbi.v6i1.10081

Zulfiani, ., S. Rosydatun, E., Hasiani, S., Rohmatulloh, G., & Zuqistya, N. (2020). Comparing Metacognitive Skill between Problem-based Learning Combine Question Student Have and Problem-based Learning Combine Learning Journal. *ICRI,* 2892–2899. https://doi.org/10.5220/0009915028922899

Zulfiani, Z., Herlanti, Y., Rosydatun, E. S., Hasiani, S., Rohmatulloh, G., & Zuqistya, N. (2018). Developing Metacognitive Skill Instrument on Fungus Concept. *Edusains, 10*(2), 243–253. https://doi.org/10.15408/es.v10i2.7919