Biogenerasi Vol 7 No 1, Maret 2022

Biogenerasi

Jurnal Pendidikan Biologi

https://e-journal.my.id/biogenerasi

ANALYZING STUDENT'S SCIENCE LITERACY AND CONTENT ASPECT OF INTERACTION OF ORGANISMS AND ITS ENVIRONMENT TOPIC AT SEKOLAH INDONESIA KUALA LUMPUR

Amaira Utami, Universitas Nahdlatul Ulama Indonesia, Indonesia
*Corresponding author E-mail: amairautami@gmail.com

Abstract

The purpose of this study is to capture student's science literacy and content aspect of interaction of organisms and its environment topic at Sekolah Indonesia Kuala Lumpur. The method of this study is quasi experiment pretest-posttest one group only. The research subject is 7th graders in *Sekolah Indonesia Kuala Lumpur*. Student's science literacy on knowledge aspect is captured through 20 multiple choice questions and questionnaire about science learning. The research data is analyzed by the result of normalized gain and its effect size. There are two aspects of science literacy which are measures namely content and procedural knowledge which enhance satisfactory of n-gain 0.52 and 0.75 respectively. The effect size of those two aspects reach 1.24 which means it has strong effect. Moreover, students mostly excel on both abiotic and ecological pyramid subtopic that are correctly answered by 64.77% students. To sum up, student's science literacy shows satisfactory results and it can be concluded that students can comprehend the topic well.

Keywords: *Science Literacy, Science, Content Knowledge, Procedural Knowledge*

Abstrak

Tujuan dari penelitian ini adalah untuk melakukan analisis literasi sains siswa dan pemahaman siswa pada setiap subtopic di materi interaksi organisme dan lingkungannya di Sekolah Indonesia Kuala Lumpur. Metode penelitian ini adalah quasi eksperimen *pretest-posttest one group only*. Subjek penelitian ini adalah siswa kelas 7 di Sekolah Indonesia Kuala Lumpur. Literasi sains siswa pada aspek pengetahuan diuji melalui 20 soal pilihan ganda dan angket tentang pembelajaran sains. Data penelitian dianalisis dengan hasil *normalized gain* dan effect size-nya. Terdapat dua aspek literasi sains yang diukur yaitu *content* dan *procedural knowledge* yang masing-masing mendapat skor n-gain 0,52 dan 0,75. Sedangkan, *effect size* dari kedua aspek tersebut mencapai 1,24 yang berarti peningkatan literasi sains siswa disebabkan kuat oleh adanya pembelajaran IPA pada mata pelajaran interaksi organisme dan lingkungannya. Selain itu, sebagian besar siswa unggul pada subtopik komponen abiotik dan piramida ekologi yang dijawab dengan benar oleh 64,77% siswa. Kesimpulannya, literasi sains siswa menunjukkan hasil yang memuaskan dan dapat disimpulkan bahwa siswa dapat memahami topik dengan baik.

Kata Kunci: *Literasi Sains, IPA, Content Knowledge, Procedural Knowledge*

Correspondence Author :
Universitas Nahdlatul Ulama Indonesia
Jl. Taman Amir Hamzah

p-ISSN 2573-5163
e-ISSN 2579-7085

INTRODUCTION

Science is important because we live in a world where nature is always changing in every second, such as the technology that never stops developing. This statement is supported by McFarlane (2013) that talking about science, it is developing as the advancement of technology. Science is real and it focuses on the realism that occurs in daily life. Science is also the reality of progress and survival that is relative to individual and societal experiences in contemporary setting. It is also known as a long tradition that science build up man's scientific way of thinking (Matthews, 2012). Science is the knowledge that is talked and written in words. It is not the ideas that are expressed by the numbers. Therefore, learning science is learning a new dialect with the acquisition with other knowledge, theories and languages (Erickson, 2012).

Science helps students develop scientific habits of mind, giving rise to the interest and the excitement that underlie decisions to participate in science especially in daily life (Hayes and Trexler, 2016). Learning science cannot be apart from human life especially for the learners, because we life in nature where everything relates to science.

Talking about science, it cannot be apart from science literacy. This statement also supported by Senturk & Sari (2018) that when student study science, the main purpose is to make them science literate, known as science literacy which is used as indicator to measure the effectiveness and quality of science education that is being taught in the classroom (Winata et al., 2016).

Science literacy is someone's ability to understand, communicate and apply science knowledge to solve real world problems faced by modern society which heavily effect on science and technology development (Toharudin, et al., 2011; Yenni, Hernani & Widodo, 2017). It is also the skill and ability comprehend by students to understand and apply basic principle of science (Lestari, 2021).

It is the understanding of real-world facts, concepts, laws and theories that includes knowledge of both the natural world and technological artefacts (content knowledge), knowledge of how such ideas are produced (procedural knowledge), and an understanding of the underlying rationale for these procedures and the justification for their use (epistemic knowledge) (OECD, 2016). Pahrudin (2019) concluded that scientific literacy is found to be essential skills to live the life at various level of education.

Science literacy has two aspects of content knowledge and procedural knowledge. Content knowledge is facts, concepts, ideas and theories about natural world that science has established. It is also known as knowledge of content science. Conceptual knowledge is more consistently and strongly supports procedural knowledge (Johnson & Schneider, 2015). Moreover, procedural knowledge of science literacy is not just practices but it also includes concept in which empirical scientific explanation and experiment occurred based on repeating measurements to minimize error and reduce uncertainty, with several procedures to gain scientific data. The task of procedural knowledge is almost always solving problems and the result measure is always accuracy, timely and procedural (Lefevre et al., 2006; Canobi, Reeve & Pattison, 2009; Schneider & Stern, 2010). Concept and procedural knowledge are two important aspect of science literacy which is also called as "concept of evidence" (Gott, Duggan & Roberts, 2008; OECD, 2016).

METHOD

The research is aimed to capture student's science literacy through quasi experiment method with one group pretest-posttest design. The subject of the research is 7th graders of Junior High School students at Sekolah Indonesia Kuala Lumpur which consists of 64 students in total. Science literacy is captured through 20 multiple choice questions. The instrument is used beside to capture student's science literacy, but it is also used to capture which of the subtopic of interaction of organisms and its environment topic mostly answered correctly by students.

The normalized gain is captured to see whether science learning could cultivate student's science literacy. The normalized gain is captured through equation as follows:

$$<g> = \frac{\%G}{\%Gmax} = \frac{(S_f - \%Si)}{(100 - \%S_i)}$$

Description:
<g> = Normalized gain
S_f = Post-test score
G = Actual gain S_i = Pretest score
G_{max} = Maximum gain possible

Table 1. N-gain Classification

Score <g>	Classification
g>0.7	High
0.7 > g ≥ 0.3	Satisfactory
g < 0.3	Low

RESULT AND DISCUSSION

Science Literacy

Science Literacy is captured by two aspects namely content knowledge and procedural knowledge. In total there are 20 questions, specifically 12 questions on content knowledge aspect and 8 questions on procedural knowledge. The result of science literacy is calculated by capture the score of normalized gain (N-gain) and Effect size.

Tabel 2 Table Pretest n Posttest

Aspect	N	Pretest	Posttest	n-gain <n>	SD	ES
Content Knowledge: Explain phenomena scientifically	12	45.78	74.13	0.52	28.10	1.01
Procedural Knowledge: Interpret data and evidence scientifically	8	50.00	87.50	0.75	46.72	0.80
Science Literacy	20	46.88	76.56	0.56	23.97	1.24

The result shows that student's science literacy enhance after science learning on interaction of organisms and its environment topic. The result of pretest shows the average of 46.88 which means student's science literacy on both content and procedural knowledge is low. However, the score rose to the average of 76.56 at the posttest for those two aspects of science literacy.

Based on the result, the normalized gain and effect size is calculated to capture whether the enhancement score has effect to science literacy. In content knowledge aspect, student's score rose from 45.78 in pretest to 74.13 in posttest. The normalized gain is 0.58 which means has satisfactory enhancement. Science learning is also proved had strong effect to student's science literacy as the score of effect size is 1.01.

On procedural knowledge aspect, student's score initially reach 50.00 and surprisingly it reaches 87.50 in the posttest. The normalized gain is calculated to reach 0.75 which means high enhancement and science learning is prove to have middle effect to student's science literacy as the effect size score is 0.80.

According to the result, student's science literacy improved better on procedural knowledge aspect than content knowledge aspect. It can be first, procedural knowledge is measuring student's skill in interpreting data, figure, chart and scientific evidence. The answer of procedural knowledge aspect is based on fact that students find and retrieve from questions, while content knowledge is what student's believe and understood. The task of procedural knowledge is proved almost always about solving problems, accuracy measurement, and understanding the data (Schnder & Stern, 2010; Lefevre et al., 2006; Canobi, 2009). If student is having skill in interpreting data, conduct mathematical measurement and scientific observation, then the students would be able to answer the questions although they have lack knowledge about the topic. However, procedural knowledge and conceptual knowledge is proved to have a linkage, students would be correctly answer the questions and having science literacy if they could combine these two knowledge. This idea is supported by (Johnson & Schneider, 2015) that conceptual understanding and procedural knowledge are the two aspect that cannot be apart.

Conceptual Understanding on Interaction of Organisms and Its Environment Topic

To see the effectiveness of each subtopics, student's correct answers were calculated

specifically on each subtopics; biotic component, abiotic component, food chain, food web, ecological pyramid and classification of organisms which is guided by Bloom's Taxonomy C1 to C4.

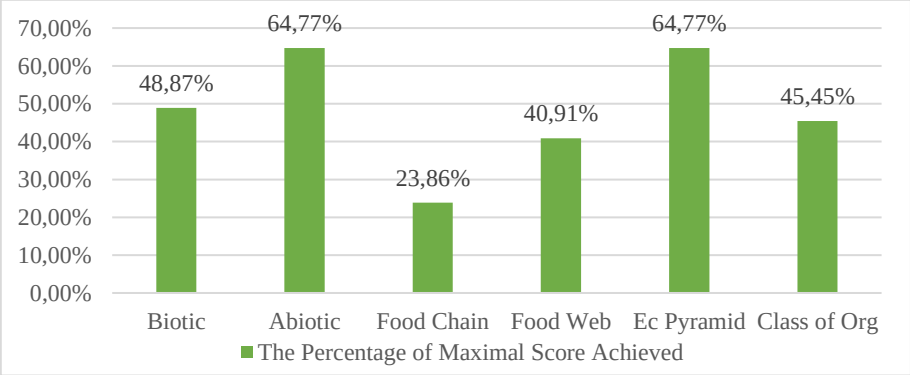

Figure 1. Percetage of Student's Correct Answer on Each Subtopics

According to the figure above, surprisingly 64.77% students answered correctly on abiotic component and ecological pyramid questions. Moreover, almost half of the students have correct answer on biotic component, food web and classification of organisms. The percentage is 48.87%, 40,91% and 45.45% respectively. However, food chain is the subtopic which three quarter of the students failed to provide correct answer. The percentage only reaches 23.86%.

Finally, it comes to conclusion that most of the students are able to provide correct answer on abiotic component and ecological pyramid subtopic, but only a quarter of students are correct answering food chain subtopic. According to the result, there must be factors that affect the achievement of students' conceptual understanding in each subtopic on interaction of organisms and its environment.

The possibilities are divided into the internal and external factors. The internal factor can be because the topic of food chain itself is found to be harder to be understood by the students. Based on student's answer, most of the students failed to analyse the type of consumers (type I, II, etc), producers, decomposers. Moreover another internal factor can be teacher's skill and learning materials. Moreover, student's prior knowledge can also influence students in answering the questions. It is in line with Al-Zoubi & Yunes (2015) stated that lack of experience and knowledge, abilities, fear of failure and lack of self-confidence often lead to academic failure.

Nulhakim, L & Setiawan (2021) found that several things need to be considered to enhance the quality of education in Indonesia especially teacher's skills, instructional materials and the lesson plan. This idea is supported by Newhouse (2017); Bissaker (2014); Hordatt Gentles (2018), Fadila, Suliyanah, Deta (2020) that student's disinterest and poor performance in science education relatively based on poor teaching and lack of relevant learning materials which has spawned negative attitudes towards science subject.

Mujtahid, et al. (2021) & Asyhari (2019) suggested that teacher's skill in learning science is needed to focus on developing student's science literacy.

Additionally Kapur (2018) stated that learning resources are vital to enhance student's academic performance as students will absolutely acquire better understanding regarding academic concept if supported by appropriate learning resources.

CONCLUSION AND RECOMMENDATION

According to the result, student's science literacy enhance moderately based on normalized gain <n-gain> of 0.56 on both content and procedural knowledge. The index effect size is 1.24 which means that science lesson on interaction of organisms and its environment has strong effect to student's science literacy. Moreover, most of students answered biotic component and ecological pyramid subtopics correctly; 64.77% while only 23.86% of the students prove correct answer on food chain subtopic.

REFERENCE

Al-Zoubi, S. M., & Younes, M. A. B. (2015). Low academic achievement: causes and results. *Theory and Practice in Language Studies*, *5*(11), 2262-2268.

Asyhari, A. (2019). Pengembangan Instrumen Asesmen Literasi Sains Berbasis Nilai-Nilai Islam Dan Budaya Indonesia Dengan Pendekatan Kontekstual. *Lentera Pendidikan: Jurnal Ilmu Tarbiyah Dan Keguruan*, *22*(1), 166-179.

Bissaker, K. (2014). Transforming STEM education in an innovative Australian school: The role of teachers' and academics' professional partnerships. *Theory into Practice*, *53*(1), 55-63.

Canobi, K. H.(2009). Concept-procedure interactions in children's addition and subtraction. *Journal of Experimental Child Psychology, 102, 131–149. doi: 10.1016/j.jecp.2008.07.008.*

Erickson, F. (2012). Qualitative research methods for science education. In*Second international handbook of science education* (pp. 1451-1469). Springer Netherlands.

Fadila, D., Suliyanah, S., & Deta, U. A. (2020). Analysis of Interest and Scientific Literacy Skills of Senior High School in Learning Physics. *Lensa: Jurnal Kependidikan Fisika*, *8*(2), 39-47.

Gott, R., Duggan, S., Roberts, R., & Hussain, A. (2008). Concepts of evidence. *School of education: University of Durham*.

Hayes, K. N., & Trexler, C. J. (2016). Testing predictors of instructional practice in elementary science education: The significant role of accountability. *Science Education*, *100*(2), 266-289.

Hordatt Gentles, C. (2018). Reorienting Jamaican teacher education to address sustainability: challenges, implications and possibilities. *Caribbean Quarterly*, *64*(1), 149-166.

Johnson, B., & Schneider, M. (2015). Developing conceptual and procedural knowledge of mathematics. *Oxford handbook of numerical cognition*, 1118-1134.

Kapur, R. (2018). Factors Influencing the Students Academic Performance in Secondary Schools in India.

LeFevre, J.-A., Smith-Chant, B. L., Fast, L., et al.(2006). What counts as knowing? The development of conceptual and procedural knowledge of countingfrom kindergarten through grade 2. *Journal of Experimental Child Psychology, 93, 285–303. doi: 10.1016/j.jecp.2005.11.002.*

Lestari, S. (2021). pengaruh model pembelajaran peer led guided inquiry terhadap kompetensi literasi sains ditinjau dari kemampuan akademik. *Jurnal Inovasi Pendidikan IPA*, *7*(1).

Matthews, M. R. (2012). Changing the focus: From nature of science (NOS) to features of science (FOS). In *Advances in nature of science research* (pp. 3-26). Springer Netherlands.

McFarlane, D. A. (2013). Understanding the challenges of science education in the 21st century: New opportunities for scientific literacy. *International Letters of Social and Humanistic Sciences*, *4*(1), 35-44.

MUJTAHID, I. M., BERLIAN, M., VEBRIANTO, R., THAHIR, M., & IRAWAN, D. (2021). The development of digital age literacy: A case study in Indonesia. *The Journal of Asian Finance, Economics, and Business*, *8*(2), 1169-1179.

Newhouse, C. P. (2017). STEM the boredom: Engage students in the Australian curriculum using ICT with problem-based learning and assessment. *Journal*

of Science Education and Technology, *26*(1), 44-57.

Nulhakim, L., & Setiawan, R. (2021). Implementation of Science and Technology Concepts in Blind Stick STEM Project through the Engineering Design Process. *SEAQIS Journal of Science Education*, *1*(1), 1-5.

OECD (2016). *PISA 2015: Assesment and analytical framework: Science, reading, mathematic and financial literacy*. Paris: OECD Publishing.

Pahrudin, M. P. (2019). The analysis of pre-service physics teachers in scientific literacy: Focus on the competence and knowledge aspects. *Jurnal Pendidikan IPA Indonesia*, *8*(1), 52-62.

Schneider, M., & Stern, E. (2010). The developmental relations between conceptual and procedural knowledge: A multimethod approach. *Developmental psychology*, *46*(1), 178.

Şentürk, C., & Sari, H. (2018). Investigation of the contribution of differentiated instruction into science literacy. *Qualitative Research in Education*, *7*(2), 197-237.

Sulistyaningrum, H., Winata, A., & Cacik, S. (2019). Analisis Kemampuan Awal 21st Century Skills Mahasiswa Calon Guru SD. *Jurnal Pendidikan Dasar Nusantara*, *5*(1), 142-158.

Toharudin, U., Hendrawati, S., & Rustaman, A. (2011). *Membangun Literasi Sains Peserta Didik*. Bandung : Humaniora.

Yenni, R., Hernani, & Widodo, A. (2017, May). The implementation of integrated science teaching materials based socio-scientific issues to improve students scientific literacy for environmental pollution theme. In *AIP Conference Proceedings* (Vol. 1848, No. 1, p. 060002). AIP Publishing.