



HOTSEP Analysis to Develop Disaster Research Integrated Book for Vocational Education (Drica) in 21st-Century

Hendrica Etmi Primarini^{1*}, Henita Rahmayanti¹, Irika Widiasanti¹,
Ilmi Zajuli Ichsan², Isil Koc³, Danilo V. Rogayan Jr.⁴, Rahmawati Darussyamsu⁵, Titin⁶,
Giry Marhento⁷, Nurfadhilah⁸, Rika Sa'diyah⁹

¹Technology and Vocational Education Program, Universitas Negeri Jakarta, Indonesia

²Elementary Teacher Education Program, Universitas Mohammad Husni Thamrin, Indonesia

³Department of Science Education, Istanbul University, Turkey

⁴Department of Natural Sciences, President Ramon Magsaysay State University, Philippines

⁵Biology Education Program, Universitas Negeri Padang, Indonesia

⁶Biology Education Program, Universitas Tanjungpura, Indonesia

⁷Biology Education Program, Universitas Indraprasta PGRI, Indonesia

⁸Public Health Program, Universitas Muhammadiyah Jakarta, Indonesia

⁹Islamic Educational Management Program, Universitas Muhammadiyah Jakarta, Indonesia

Article History:

Received: April 15th, 2021

Revised: May 7th, 2021

Accepted: September 1st, 2021

Published: December 31st, 2021

Keywords:

HOTSEP,

Learning media,

Vocational school students

*Correspondence Address:

hendrica131680@gmail.com

Abstract: This study analyzed Higher-Order Thinking Skills of Environmental Problem (HOTSEP). It was conducted in March 2021. The sample comprised 114 vocational high school students, 66 male and 49 female students from several schools in Jakarta, Indonesia. The data was collected online using Google Form and Microsoft Excel for data analysis. The results showed that the HOTS score with analyzing environmental problems (C4) obtained an average score of 50. The thinking aspect of evaluating environmental problems (C5) obtained an average score of 49. The thinking aspect of making programs to overcome environmental problems (C6) obtained an average score of 47. Therefore, the study showed that the HOTS scores were relatively low since the average score was 51. The results showed that the HOTSEP score on the criticizing environmental problems (C4) obtained an average score of 24. The thinking aspect of environmental problem solving (C5) obtained an average score of 25. Furthermore, the thinking aspect of environmental innovation development (C6) obtained an average score of 23. Therefore, the study showed that the HOTSEP score was poor since the average score was 26. The research results suggest that learning media employed requires an improvement related to disaster mitigation. One media that can be developed is Disaster Research integrated book for Vocational Education (Drica). It can be concluded that the research results generally indicate that the vocational education students remain lacking in the HOTSEP aspect.

INTRODUCTION

The environment is all things and situations that comprise mutually interacting things and organisms (Blanco & Lozano, 2015; Dangelico et al., 2017). The environment is an essential

component for the organism to survive on earth and develop according to its abilities.

Disaster is a consequence of an environmental event or man-made conflict that gives rise to significant

tension, injury, physical destruction, and economic disturbance (Rogayan & Dollete, 2020). This disaster must be addressed in several ways; one of them is education (Ramadhan et al., 2019; Siriwardena et al., 2013).

According to Saito (2013), environmental education is the mainframe for societies to acquire various knowledge, awareness, and handling of the environment to protect biodiversity. In addition, it is a concept related to conservation efforts. Environmental education roles include manifesting environmental preservation and improving students' knowledge, behavior, and better attitude implementation (Istiana & Awaludin, 2018). Environmental education, however, must be ongoing and sustainable so that students' concepts and implementation in understanding and solving environmental problems can be well achieved (Ichsan & Rahmayanti, 2020).

Vocational high school students play a role as Generation Z learners to promote various environment-friendly life patterns. Students' environmental knowledge influences these life patterns. Increasing the environmental knowledge will require educators capable of developing students' constructive skills in learning gradual steps to develop individual behavior towards environmentally friendly life patterns and apply one of the principles in teaching 21st-century skills that include enhancing students' creativity (Setiadi, 2019).

Improving Higher-order Thinking Skills (HOTS) is necessary to support environmental knowledge improvement through vocational education. HOTS entail cognitive skills, including analysis and evaluation processes; hence, it is expected to efficiently and appropriately overcome environmental problems. Having higher HOTS has proven to be a factor in improving skills to handle environmental problems. Research results by Suharini et al. (2020) suggest that low

HOTS affects skills to produce quick solutions in unforeseen situations during the COVID-19 pandemic and HOTS need to be integrated with local environmental ecology and geography so that students can anticipate environmental problems and immediately participate in handling environmental problems in their surroundings.

Performing learning system revitalization is expected in facing 21st-century learning challenges. Rogayan Jr et al., (2021) averred that improving the 21st-century skills of learners can expressively assist them in becoming a future-ready and globally-competent workforce in the global economy in the context of the fourth industrial revolution. Relatedly, Setiadi (2019) states that graduates of vocational school students are expected to have capabilities in critical and creative thinking, collaborating, and solving problems. The problem-solving skills can be enhanced through creative thinking skills (Khoiriyah & Husamah, 2018). Ichsan & Rahmayanti (2020) opine that HOTS can be explicitly measured in environmental topics or known as Higher-order Thinking Skills of Environmental Problem (HOTSEP). Not many previous studies measure HOTSEP in vocational school students; therefore, it is essential to conduct the study. This is due to the need to acquire relevant skills in environmental learning to address 21st-century environmental problems (Hidayati et al., 2021; Ichsan et al., 2019).

Environmental education in the 21st-century calls for various innovations in disaster mitigations. Therefore, an innovation of HOTSEP-based learning media could support environmental learning in vocational school students. One media is Disaster Research integrated book for Vocational Education (Drica). The benefit of Disaster research integrated book for vocational education (Drica) is that it provides an easy-to-read and varied source of subject matter

needed in the learning process, especially to improve the skills, understanding, and abilities of vocational school students in solving environmental problems related to solid waste and natural disasters, in particular. Flood, as well as increasing the ability to innovate in environmental problems. This study aims to examine the HOTSEP of vocational school students as the foundation for Drica's development.

METHOD

Participant

The data and research sample collection were carried out in March 2021. The research sample consisted of 114 vocational school students from several schools in Jakarta, Indonesia, which were selected using simple random sampling. The sample consisted of 66 male and 49 female students. The data was collected online via Google Form.

Instrument or Measure

This study used a descriptive method with the survey as the data

collecting technique. The instrument used was HOTS with level three thinking levels: analyzing environmental problems (C4), evaluating environmental problems (C5), and making programs to overcome environmental problems (C6). Furthermore, the HOTSEP consisted of three thinking levels: criticizing environmental problems (C4), solving environmental problems (C5), and developing environmental innovations (C6).

Data Analysis

The research data carried out HOTSEP descriptive analysis to measure students' knowledge in an environmental learning context. The descriptive method will be beneficial for measuring something relatively quickly (Abdullah et al., 2017; Hunaepi et al., 2019; Sigit et al., 2020). The data analysis employed HOTS categories. The results were categorized in HOTS categories.

Table 1. Students' HOTS Categories

Category	Interval Score
Excellent	$X > 81.28$
High	$70.64 < X \leq 81.28$
Medium	$49.36 < X \leq 70.64$
Low	$38.72 < X \leq 49.36$
Poor	$X \leq 38.72$

Source: category score and interval adapted from (Ichsan et al., 2019)

Table 2. HOTSEP Categories in Environmental Learning

Category	The interval of Students' HOTSEP Score
Excellent	$X > 81.28$
High	$70.64 < X \leq 81.28$
Medium	$49.36 < X \leq 70.64$
Low	$38.72 < X \leq 49.36$
Poor	$X \leq 38.72$

Source: category score and interval adapted from Hidayati et al. (2021)

Data were analyzed using Microsoft Excel. The study employed a research technique of averaging each item and each indicator. This data analysis method facilitated the measurement of the HOTSEP number for each indicator. The researchers utilized the HOTSEP

instrument with three thinking levels/aspects, namely, criticize environmental problems (C4), solve environmental problems (C5), and develop environmental innovations (C6). The researchers referred to thinking level patterns from Ichsan & Rahmayanti

(2020) taxonomy, a cognitive process. The research also measured HOTS, where its indicators were developed based on

HOTS aspects according to Anderson et al. (2001). The HOTS measurement is aimed at comparing HOTS and HOTSEP.

Table 3. HOTS Indicators

Aspect	Indicator	Question Number
C4 (Analyze)	Analyze the causes of a large amount of waste in the surrounding environment and its consequences on the environment	1 and 2
C4 (Analyze)	Analyze the 4R Principle, namely Reduce, Reuse, Recycle, and Replace	3 and 4
C5 (Evaluate)	Evaluate the occurrence of the increasing number of waste in the surrounding environment	5 and 6
C5 (Evaluate)	Evaluate steps of the 4R Principle that have occurred in the surrounding community.	6 and 8
C6 (Create)	Create hypotheses on the influence of the 4R Principle management following existing regulations.	9 and 10
C6 (Create)	Create waste management programs according to the 4R Principle	11 and 12

Table 4. HOTSEP Indicators

Aspect	Indicator	Question Number
C4 (Criticize)	Criticize the behavior of people who are still littering and not protecting the environment.	1 and 2
C4 (Criticize)	Criticize community roles in waste management based on 4R Principles, namely Reduce, Reuse, Recycle, and Replace.	3 and 4
C5 (Solve Problems)	Solve waste management problems in their environment	5 and 6
C5 (Solve Problems)	Provide solutions to waste management problems based on the 4R Principle.	6 and 8
C6 (Develop Innovation)	Students could develop innovative projects to address waste accumulation; thus, it does not interfere with the survival of organisms (plants, animals, and humans) according to the 4R Principle and type of waste (organic and inorganic waste).	9 and 10
C6 (Develop Innovation)	Create waste management programs compliant with the 4R Principle.	11 and 12

RESULT AND DISCUSSION

The research results indicated that the students' HOTS categories were still in a medium category for environmental problem learning, especially waste, and it needed an improvement. The lowest score

was item 12, which was related to creating hypotheses and waste management programs according to the 4R principles. The detailed results are presented in Table 5.

Table 5. Average Score of HOTS for each Item

No	Item	Total n=114	Male n= 66	Female n=49
1	Analyze the causes of the increasing number of waste in the environment around the residence.	5.1	5.0	5.3
2	Analyze whether or not waste accumulation occurs in the surrounding environment	5.3	5.1	5.5
3	Analyze the 4R Principle in waste management activities	5.0	4.8	5.3
4	Analyze activities that reflect the 4R Principle in daily life.	4.7	4.7	4.6
5	Doable activities to prevent the accumulating waste in the surrounding environment.	4.6	4.5	4.8
6	Activities that could impact the decreasing number of waste in the surrounding environment.	4.9	4.9	5.0

No	Item	Total n=114	Male n= 66	Female n=49
7	Express arguments on 4R Principle activities that occurred in the surrounding environment.	4.6	4.5	4.7
8	Obstacles emerged from implementing the 4R Principle activities in the surrounding environment through a program and idea.	5.5	5.3	5.7
9	State ideas on the 4R Principle activities that can positively impact the environment.	5.3	5.1	5.5
10	Create programs and steps of the 4R Principle activities beneficial for improving environmental cleanliness and health.	5.6	4.9	5.8
11	Create simple programs on waste management methods according to the 4R Principle at home.	5.6	5.5	5.7
12	Create flagship programs if you are assigned as an officer responsible for the cleanliness and awareness to waste in the environment at RW (neighborhood association) level so that the 4R-principle waste management system could run well and the results are beneficial for people in the RW.	4.5	3.4	3.5
Total average Category		51	48 Low	53

The research results suggested that the students' HOTSEP categories were still in the poor category in environmental problem learning, especially waste, and it needed an improvement. Items with the

lowest score were items 10 and 11 related to developing innovative projects to overcome the problem of accumulating waste and creating waste management programs.

Table 6. Average Score of HOTSEP for Each Item

No	Item	Total n=114	Male n= 66	Female n=49
1	Criticize people in an environment who are not implementing proper waste disposal methods and who seem indifferent to the environment and its impacts on the environment.	2.3	2.1	2.6
2	Criticize an environment containing scattered garbage, and a good management system is not available.	2.8	2.6	2.9
3	Provide critiques through social media on community awareness to the need for waste management according to the 4R Principle	2.7	2.5	2.9
4	Criticize households that produce less waste and those that produce more waste	2.6	2.6	2.6
5	Solve waste management problems in the household environment that will influence the waste management system in the household and the surrounding environment.	2.7	2.2	2.7
6	Solving waste management system problems provide an economic added value for waste management actors.	2.5	2.2	2.8
7	Provide solutions to waste management problems.	3.1	2.8	3.3
8	Provide solutions to the application of the 4R Principle so that waste management could run well.	2.5	2.3	2.7
9	Address waste accumulation so that it does not interfere with the survival of organisms (plants, animals, and humans) according to the 4R Principle.	2.8	2.7	2.9
10	Develop innovative projects if waste accumulation is occurred based on type of waste, organic and inorganic waste.	2.2	1.9	2.4
11	Develop innovations in utilizing good waste management so that waste in the surrounding environment has beneficial economic values.	2.6	2.6	2.6
12	Create innovative products produced from garbage waste in the surrounding environment according to your field of interest in the vocational high school.	2.2	2.1	2.2
Total average Category		26	24 Poor	27

Table 7. Average Score of HOTS for Each Thinking Aspects/Levels

No	Aspect	Total n=114	Male n= 66	Female n=49
1	C4 (Analyze)	5.0	4.9	5.2
2	C5 (Evaluate)	4.9	4.8	5.0
3	C6 (Create)	5.9	4.7	5.1

Table 8. Average Score of HOTSEP for Each Thinking Aspects/Levels

No	Aspect	Total n=114	Male n= 66	Female n=49
1	C4 (Criticize)	2.4	2.4	2.8
2	C5 (Provide Solutions/Solve problem)	2.5	2.5	2.9
3	C6 (Develop Innovations)	2.3	2.3	2.5

The research results indicated that the HOTS scores were still relatively low. The HOTS scores confirmed this for each aspect (Table 7). The HOTSEP scores, on the other hand, were in a poor category. This was validated by the HOTSEP scores for each aspect (Table 7).

Based on the Research, there were differences in the average value between HOTS and HOTSEP measurements. In the HOTS measurement, the average score was 51 (low), whereas the HOTSEP measurement was 26 (poor) in overcoming environmental pollution related to natural disasters.

The results of the HOTS table were 48 for male students or in a low category and 53 for female students or in the medium category. The HOTSEP table indicates results of 24 for male students or in a low category and 27 for female students or in a poor category. The HOTS level and the HOTSEP level both indicated that female students had higher average scores than male students. This is consistent with Hidayati et al. (2021) that women have better high-level thinking skills or HOTS and new high-level thinking skills or HOTSEP than men in analyzing problems (C4), evaluating (C5), and creating (C6) as well as in criticizing problems (C4), providing solutions (C5), and developing environmental innovations (C6). These instruments evaluated students' knowledge based on various waste-related environmental problems. And innovative skills to

innovate using waste into economic value products (Diana et al., 2018)

The development of students' higher-order thinking skills (HOTS), which is demonstrated through environmental problems related to waste, will be able to help students to create ideas or ideas clearly, argue well, be able to solve problems, be able to construct explanations, be able to hypothesize and understand complex things into more clearly (Kurniasih, 2018). However, only some students could solve problems and some experienced difficulties. (Abdullah et al., 2015; Saraswati & Agustika, 2020). This is a challenge that must be faced in the future so that to meet this challenge requires the development of higher-order thinking skills (HOTS), which is a teaching system that fosters students' skills and dispositions towards critical thinking (Aizikovitsh-Udi & Cheng, 2015), practicing thinking strategies high level, encourages open class discussion and conducts inquiry-oriented experiments (Miri et al., 2014).

Teaching that can improve the critical thinking skills of vocational school students in overcoming environmental problems and natural disasters can be done by carrying out learning that is oriented towards increasing HOTS and HOTSEP through various learning media, learning content, learning models, and developing learning strategies (Husamah et al., 2018; Ichsan et al., 2019; Istiyono et al., 2018; Ichsan et al., 2020). Modules and ebooks are very

efficient in improving HOTS and HOTSEP abilities (Puspitasari et al., 2020; Lastuti, 2018; Rofiah et al., 2018).

Based on the HOTS and HOTSEP research results on vocational school students in solving environmental problems, which still show the HOTS category, which produces low scores, and the HOTSEP category, which produces poor scores, it is necessary to make appropriate innovations. Appropriate innovation must be implemented to increase the understanding and ability of vocational school students in solving environmental problems related to solid waste and natural disasters, especially floods, and to increase their ability to innovate. One of these efforts can be made by developing an integrated book learning media for Disaster Research for vocational education (Drica); Therefore, students' critical thinking skills according to HOTS and HOTSEP measurements can be improved.

The benefit of Disaster research integrated book for vocational education (Drica) is that it provides an easy-to-read and varied source of subject matter needed in the learning process, especially to improve the skills, understanding, and abilities of vocational school students in solving environmental problems related to solid waste and natural disasters, in particular. Flood, as well as increasing the ability to innovate in environmental problems. Because improving students thinking skills can create wise behavior towards the environment (Nisa et al., 2018)

This Drica learning innovation is expected to be widely used. This is due to the technology-based educational innovation could facilitate the delivery of information related to disaster mitigation. Other innovations must be conducted that could encourage sustainable HOTSEP formation.

CONCLUSION

The research results indicated that the HOTSEP and HOTS related to waste still require an improvement. The results suggested the lack of innovation development regarding environmental problems, especially waste among the vocational school students. This was related to their lack of skills to be creative and to utilize information sources and knowledge on environmental problems, particularly in waste and natural disasters. Waste problems that are not handled properly will cause new problems, for instance, flooding. The floods that occur in Jakarta are due to high rainfall and the large amount of waste that is not handled properly. The researcher suggests the development of Drica in the future to improve HOTSEP in a natural disaster of vocational school students.

REFERENCES

- Abdullah, A. H., Abidin, N. L. Z., & Ali, M. (2015). Analysis of students' errors in solving Higher Order Thinking Skills (HOTS) problems for the topic of fraction. *Asian Social Science*, 11(21), 133–142. <https://doi.org/10.5539/ass.v11n21p133>
- Abdullah, A. H., Mokhtar, M., Halim, N. D. A., Ali, D. F., Tahir, L. M., & Kohar, U. H. A. (2017). Mathematics teachers' level of knowledge and practice on the implementation of higher-order thinking skills (HOTS). *Eurasia Journal of Mathematics, Science and Technology Education*, 13(1), 3–17. <https://doi.org/10.12973/eurasia.2017.00601a>
- Aizikovitsh-Udi, E., & Cheng, D. (2015). Developing critical thinking skills from dispositions to abilities: Mathematics education from early childhood to high school. *Creative Education*, 06(04), 455–462. <https://doi.org/10.4236/ce.2015.64045>

- Anderson, L. W., Krathwohl, D. R., Airasian, W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., & Wittrock, M. C. (2001). *A taxonomy for learning, teaching and assessing: A revision of bloom's taxonomy of educational objectives*. Longman.
- Blanco, E., & Lozano, J. (2015). Ecolabels, uncertified abatement, and the sustainability of natural resources: An evolutionary approach. *Journal of Evolutionary Economics*, 25(3), 623–647. <https://doi.org/10.1007/s00191-015-0403-y>
- Dangelico, R. M., Pujari, D., & Pontrandolfo, P. (2017). Green product innovation in manufacturing firms: A sustainability-oriented dynamic capability perspective. *Business Strategy and the Environment*, 26(4), 490–506. <https://doi.org/10.1002/bse.1932>
- Diana, S., Marlina, M., Amalia, Z., & Amalia, A. (2018). Pemanfaatan sampah plastik menjadi produk kerajinan tangan bernilai ekonomis bagi remaja putus sekolah. *Jurnal Vokasi - Politeknik Negeri Lhokseumawe*, 1(1), 68–73. <https://doi.org/10.30811/vokasi.v1i1.570>
- Hidayati, S., Yusandika, A. D., Anwar, C., Rahmayanti, H., Ichsan, I. Z., & Rahman, M. M. (2021). Science and environment for education: Measuring HOTSEP of electricity energy topic using Ichsan and Rahmayanti taxonomy. *Journal of Physics: Conference Series*, 1796(1). <https://doi.org/10.1088/1742-6596/1796/1/012095>
- Hunaepi, H., Dewi, I. N., & Sumarjan, S. (2019). Profiling students' environmental care attitudes taught using Sasak Tribe local wisdom-integrated model. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 5(3), 549–558. <https://doi.org/10.22219/jpbi.v5i3.10009>
- Husamah, H., Fatmawati, D., & Setyawan, D. (2018). OIDDE learning model: Improving higher order thinking skills of biology teacher candidates. *International Journal of Instruction*, 11(2), 249–264. <https://doi.org/10.12973/iji.2018.11217a>
- Ichsan, I. Z., & Rahmayanti, H. (2020). HOTSEP: Revised Anderson's taxonomy in environmental learning of COVID-19. *European Journal of Educational Research*, 9(3), 1257–1265. <https://doi.org/10.12973/eujer.9.3.1257>
- Ichsan, I. Z., Rahmayanti, H., Purwanto, A., Vivanti, D., Miarsyah, M., & Weslem, P. (2020). HOTS-AEP-COVID-19 and ILMIZI learning model: The 21 st -century environmental learning in senior high school. *Jurnal Pendidikan Biologi Indonesia*, 6(2), 265–272. <https://doi.org/https://doi.org/10.22219>
- Ichsan, I. Z., Sigit, D. V., Miarsyah, M., Ali, A., Arif, W. P., & Prayitno, T. A. (2019). HOTS-AEP: Higher order thinking skills from elementary to master students in environmental learning. *European Journal of Educational Research*, 8(4), 935–942. <https://doi.org/10.12973/eujer.8.4.935>
- Istiana, R., & Awaludin, M. T. (2018). Enhancing biology education students ability to solve problems in environmental science material through inquiri model-based lesson study. *Biosfer: Jurnal Pendidikan Biologi*, 11(1), 57–66. <https://doi.org/10.21009/biosferjpb.11-1.6>
- Istiyono, E., Dwandaru, W. S. B., Setiawan, R., & Megawati, I. (2018). Developing of Computerized adaptive testing to measure physics

- higher order thinking skills of senior high school students and its feasibility of use. *European Journal of Educational Research*, 9(1), 91–101. <https://doi.org/10.12973/euler.7.3.555>
- Khoiriyah, A. J., & Husamah, H. (2018). Problem-based learning: Creative thinking skills, problem-solving skills, and learning outcome of seventh grade students. *Jurnal Pendidikan Biologi Indonesia*, 4(2), 151–160. <https://doi.org/10.22219/jpbi.v4i2.5804>
- Kurniasih, D. I. (2018). Pengembangan e-book untuk meningkatkan higher order thinking skills (HOTS) siswa. *Prosiding Seminar Nasional Pendidikan Ekonomi*.
- Lastuti, S. (2018). Pengembangan bahan ajar berbasis HOTS untuk meningkatkan kemampuan pemecahan masalah matematis mahasiswa. *Kreano: Jurnal Matematika Kreatif-Inovatif*, 9(2), 191–197. <https://doi.org/10.15294/kreano.v9i2.16341>
- Miri, B., David, B. C., & Uri, Z. (2014). Purposely teaching for the promotion of higher-order thinking skills: A case of critical thinking. *Research in Science Education*, 37(4), 353–369. <https://doi.org/10.1007/s11165-006-9029-2>
- Nisa, N. C., Nadiroh, N., & Siswono, E. (2018). Kemampuan berpikir tingkat tinggi (Hots) tentang lingkungan berdasarkan latar belakang akademik siswa. *Jurnal Ilmiah Pendidikan Lingkungan Dan Pembangunan*, 19(02), 1–14. <https://doi.org/10.21009/plpb.192.01>
- Puspitasari, R., Hamdani, D., & Risdianto, E. (2020). Pengembangan e-modul berbasis HOTS berbantuan flipbook marker sebagai bahan ajar alternatif siswa SMA. *Jurnal Kumparan Fisika*, 3(3), 247–254. <https://doi.org/10.33369/jkf.3.3.247-254>
- Ramadhan, S., Sukma, E., & Indriyani, V. (2019). Environmental education and disaster mitigation through language learning. *IOP Conf. Series: Earth and Environmental Science*, 314. <https://doi.org/10.1088/1755-1315/314/1/012054>
- Rofiah, E., Aminah, N. S., & Sunarno, W. (2018). Pengembangan modul pembelajaran IPA berbasis high order thinking skill (HOTS) untuk meningkatkan kemampuan berpikir kritis siswa Kelas VIII SMP/MTs. *INKUIRI: Jurnal Pendidikan IPA*, 7(2), 285. <https://doi.org/10.20961/inkui.v7i2.22992>
- Rogayan, D. V., & Dollete, F. (2020). Disaster awareness and preparedness of barrio community in Zambales, Philippines: Creating a baseline for curricular integration and extension program. *Review of International Geographical Education Online*, 10(2), 92–114. <https://doi.org/10.33403/rigeo.634564>
- Rogayan Jr, D. V., Gallardo, C. B., Lacaste, J. T., & Roque, D. J. A. (2021). 21st-century skills of social studies students: Basis for a proposed training program. *International Journal of Multidisciplinary: Applied Business and Education Research*, 2(2), 195–205.
- Saito, C. H. (2013). Environmental education and biodiversity concern: beyond the ecological literacy. *American Journal of Agricultural and Biological Science*, 8(1), 12–27.
- Saraswati, P. M. S., & Agustika, G. N. S. (2020). Kemampuan berpikir tingkat tinggi dalam menyelesaikan soal HOTS mata pelajaran matematika. *Jurnal Ilmiah Sekolah Dasar*, 4(2), 257. <https://doi.org/10.23887/jisd.v4i2.25>

336

- Setiadi, H. (2019). Peran teknologi pendidikan dalam mengembangkan dan meningkatkan keprofesionalan pendidik di era revolusi industri 4.0. *Prosiding Seminar Nasional Teknologi Pendidikan Pascasarjana UNIMED*, 395–401.
- Sigit, D. V., Miarsyah, M., Komala, R., Suryanda, A., Ichsan, I. Z., & Fadrikal, R. (2020). EECN: Analysis, potency, benefit for students knowledge and attitude to conserve mangroves and coral reefs. *International Journal of Instruction*, 13(1), 125–138. <https://doi.org/10.29333/iji.2020.1318a>
- Siriwardena, M., Malalgoda, C., Thayaparan, M., Amaratunga, D., & Keraminiyage, K. (2013). Disaster resilient built environment: Role of lifelong learning and the implications for higher education. *International Journal of Strategic Property Management*, 17(2), 174–187. <https://doi.org/10.3846/1648715X.2013.806373>
- Suharini, E., Kurniawan, E., & Ichsan, I. Z. (2020). Disaster mitigation education in the COVID-19 pandemic: A case study in Indonesia. *Sustainability (United States)*, 13(6), 292–298. <https://doi.org/10.1089/sus.2020.0053>