Tadris: Jurnal Keguruan dan Ilmu Tarbiyah 6 (1): 117-124 (2021)
DOI: 10.24042/tadris.v6i1.8689

TADRIS: JURNAL KEGURUAN DAN ILMU TARBIYAH
(Tadris: Journal of Education and Teacher Training)
P-ISSN: 2301-7562 | E-ISSN: 2579-7964
ejournal.radenintan.ac.id/index.php/tadris/index

An Overview of Students' HOTS to Develop Instructional Kit for Disaster Mitigation based on Vocational Education

Yuwita Novyanti [1]*, Henita Rahmayanti[1,2], Sylvira Ananda Azwar[1], Ilmi Zajuli Ichsan[2], Charanjit Kaur Swaran Singh[3], Md. Mehadi Rahman[4,5], Rahmawati Darussyamsu[6], Ahmad Ali[7]

[1]Department of Technology and Vocational Education, Universitas Negeri Jakarta, Indonesia
[2]Department of Environmental Education, Universitas Negeri Jakarta, Indonesia
[3]Faculty of Languages and Communication, Universiti Pendidikan Sultan Idris, Malaysia
[4]Institute of Education and Research, University of Dhaka, Bangladesh
[5]Bangladesh Bank-Central Bank of Bangladesh, Bangladesh
[6]Department of Biology Education, Universitas Negeri Padang, Indonesia
[7]Department of Biology Education, UIN Alauddin Makassar, Indonesia

Article History:
Received: April 9th, 2021
Revised: April 27th, 2021
Accepted: May 28th, 2021
Published: June 29th, 2021

Keywords:
Disaster mitigation,
HOTS,
Victims,
Vocational school students

***Correspondence Address:**
yuwita.novyanti@gmail.com

Abstract: Flooding that occurred recently has become a very detrimental disaster for the victims. This flood disaster is still a concern for people in Indonesia. Flood mitigation needs to be done to all levels of society, especially vocational school students. Vocational school students must be responsive in any situation because, after graduation, they are ready to work. Disaster mitigation is essential to be included in learning at school. Disaster mitigation is also related to the Higher-Order Thinking Skills (HOTS) to always be ready and alert. In measuring vocational school students' understanding of disaster mitigation, initial research was carried out related to disaster mitigation and HOTS. The research subjects were 100 students of Vocational School in Jakarta who were randomly selected. This study used Google Forms as a data collection technique. The results showed that the students' HOTS score was still low. The results showed that the Students' HOTS scores on flooding were still low. The average score obtained by the whole students was 43.34. The male students obtained 30.27, and the female students obtained 45.97. All schools in Indonesia should implement early mitigation education that is integrated with HOTS learning.

INTRODUCTION

Indonesia is a unique country. It consists of many regions and has two seasons in a year, namely dry and rainy seasons. Both seasons have different characteristics. Besides, both seasons bring various situations to Indonesia; for example, the economic crisis currently occurred due to Coronavirus Disease (COVID 19) pandemic. During the pandemic, natural disasters also occur, such as volcanic eruption, earthquake, tsunami, and floods. These disasters occurred due to human negligence. These quaint economic conditions, along with the disasters, often have an impact on the Indonesian economy. Rapid development in knowledge and technology affects infrastructures and skyscrapers' development. This development must be carried out in an environmentally friendly way (Hu & Zheng, 2020; Monfaredzadeh & Berardi, 2015; Yedla & Park, 2017). Every development must consider an

Environmental Impact Assessment to minimize the impacts on the surrounding ecosystem. Environmental issues are severe problems in Indonesia as well as in the world. Environmental damage instigates an ecological crisis that triggers a series of problems. The environment determines life dynamics, public health, spiritual and moral development.

Sustainable urban development requires three main dimensions, namely mitigation, adaptation, and innovation. Disaster early warning or disaster mitigation is one of the efforts to play down the disasters. The disaster mitigation must be conducted with innovative and creative development at all community levels, both urban and rural communities, especially students as the next generation. The disaster mitigation for students must be introduced at an early age (Renald et al., 2016; Tkachuck et al., 2018; Xu & Lu, 2018). Disaster mitigation education or training from an early age can reduce the risk of disaster before, while, and after the disaster.

This disaster mitigation starts from elementary school to college. School places where students can gain knowledge and become socialize about disaster mitigation. Science knowledge can be combined with learning from the surrounding environment to make effective disaster mitigation education for school students (Kurnia & Fauzi, 2020). Vocational high school is a school that prepares its students to work using their competencies acquired during their study at the school. The vocational high school emphasizes practical and functional skills that contain theoretical aspects and equip students with skills (Utami & Hudaniyah, 2013).

Another study led by Rusilowati et al. (2012) showed the significance of educating students from both the elementary and junior high schools on disaster mitigation that can guide them to safeguard and stay protected during a crisis. Education is one of the ways that can be implemented to impart skills and knowledge to the students to have an increased awareness of the natural disaster. Azizah et al. (2013) have carried a study among high school students discussing the importance of creating awareness on educating students to become critical thinkers and are prepared to face the disasters they may face in the future.

Floods often occur due to less awareness of communities, deforestation at the upstream, land conversion, and industry. Lack of socialization from the government regarding environmental preservation also plays a role that encourages violation by the communities. Moreover, less anticipation from the government to the dangers of a disaster, causing the disaster to get worse (Bakti et al., 2017).

Vocational school students as a millennial generation are a milestone in creating innovative and creative works. They are at the age of creating a work; thus, they must develop Higher-order Thinking Skills (HOTS) because they are required to face a fast-changing and unpredictable situation or condition in the future. This skill can analyze, evaluate, and create solutions, particularly those related to disaster mitigation (Rahmayanti et al., 2020). Learning can assist students in expanding their knowledge and awareness that can be useful to deal with the negative impacts of natural disasters. It would pave the way for humans in the future by making them more competent to tackle any disasters (Kamil et al., 2020). Therefore, it is essential to incite disaster mitigation in the teenage years to minimize spiritual and material risks and be prepared when disasters occur (Suharini et al., 2020). Previous studies indicated that students' HOTS, particularly in overcoming disaster, must be improved. Other studies have shown that students who are trained to think critically often positively impact their

educational development (Hasan, 2019; Suharini et al., 2020).

It becomes essential to develop mitigation knowledge at the vocational high school level. The knowledge and experience acquired by vocational school students can manipulate their attitudes and concern for disaster mitigation in later life. Previous studies did not explain students' HOTS in detail. Hence, the current research that descriptively explains vocational school students' HOTS becomes necessary to carry out. Learning media in the form of instructional kits can be used in developing students' HOTS. Thus, this research aims to analyze vocational school students' HOTS descriptively to develop an instructional kit for disaster mitigation.

METHOD

The type of research used is descriptive with online survey data collection techniques by filling out the questionnaire on Google Form. The research questionnaires were distributed via WhatsApp group. Research respondents were randomly selected but met the criteria, such as the tenth-grade, vocational high school students aged 15-19. The research was carried out in March 2021. The sampling technique used was simple random sampling because it is more effective and efficient. The samples of this research were taken from one vocational school student in Jakarta. The samples consisted of 100 students comprised of 70 male and 30 female between 15-19 years old. The samples were students who live in Jakarta and its surroundings as these areas are flood-prone areas. HOTS instruments were made by creating grids that consisted of six indicators. The grids were then developed into 12 questions (Table 1). It is valid because an expert has checked it. Variables measured in the HOTS referred to flood topics and their prevention and mitigation efforts.

The instrument was presented in essay questions where the students should respond to the written questions. The scores for each question were 1-10; therefore, if the students have low analysis and thinking, then the score will be adjusted, and vice versa. A score of 1 is given if the student answers incorrectly. A score of 2 is given if the student answers incorrectly but is still far-related. A score of 3 is given if the student answers incorrectly but is somewhat related. A score of 4 is given if the student answers incorrectly but is still slightly related. A score of 5 is given if The student answers incorrectly but is related. A score of 6 is given if the student answers briefly but is close to appropriate. A score of 7 is given if the student answers briefly but accordingly. A score of 8 is given if the student answers with a bit of explanation. A score of 9 is given if the student answers with an explanation close to the explanation. Lastly, a score of 10 is given to the student who answers the most appropriate explanation. The maximum score was 120.

Table 1. The Indicators of Higher-Order Thinking Skills (HOTS) on Flood Disaster Mitigation.

Thinking Level	Indicators	Item
Analyze	Analyze factors related to flood disaster occurrence	1,2
Analyze	Analyze impacts of littering that causes blockage of drains	3,4
Evaluate	Evaluate the effectiveness of bio pores/infiltration wells on the lands of residents' houses and urban forest expansion	5,6
Evaluate	Criticize people who litter	7,8
Create	Create a program to minimize flood disaster	9,10
Create	Create an environmental preservation program through socialization in the communities to invite them to prevent flood, be wise in throwing garbage, and in making bio pores	11,12

Indicator adapted from (Jazuli et al., 2020)

Once the measurement of vocational school students' understanding of floods and their mitigation related to HOTS was completed, the data were analyzed using statistical scores in Microsoft Excel. The analysis results were interpreted according to categories and score interval presented in Table 2 and explained based on categories to be examined in the result and discussion.

Table 2. HOTS Categories and Interval Scores of Flood Disaster Mitigation.

Category	Interval Score
Very High	$X > 81.28$
High	$70.64 < X \leq 81.28$
Moderate	$49.36 < X \leq 70.64$
Low	$38.72 < X \leq 49.36$
Very Low	$X \leq 38.72$

RESULT AND DISCUSSION

The research results indicated that the HOTS score of the vocational school students was in a low category. Most of the students had not explained flood and its mitigation; therefore, they gave a short answer based on their knowledge.

The lowest score from questions related to flood and its mitigation packaged in HOTS form was related to analyzing several regions in Indonesia that have experienced land subsidence due to rapid development. Land subsidence primarily causes floods.

Table 3. HOTS Categories and Interval Score of Flood Disaster Mitigation

No	Item	Average Score
1	Explain why floods often occur in Jakarta and its surroundings. Write down your analysis results.	3.66
2	Write down your analysis results of factors related to floods.	3.63
3	The phenomenon of littering plastic waste is common. Make an appropriate analysis of this phenomenon.	3.62
4	Land subsidence due to construction could cause floods. Analyze this statement.	3.41
5	One of the policies to address floods is by making bio pores. Give an evaluation of the policy.	3.44
6	The phenomenon of the narrower urban forest due to development causes a decrease in water infiltration. Give your criticism of the phenomenon.	3.65
7	Some students still throw trash under their table. Give criticism to the behavior.	3.72
8	The phenomenon of garbage in floodgates is evidence that the people of Jakarta are not fully aware of environmental deterioration. Provide evaluation of the phenomenon.	3.45
9	Students must possess creative and innovative thinking to address flood problems. Create a program that you could implement around your house.	3.6
10	There are various government programs to minimize floods. Create a program to overcome floods.	3.45
11	Give an idea by inviting communities to prevent floods.	3.64
12	Create an idea so that people could aware of environmental preservation, for example, the making of bio pores in their home environment	3.59
Average of all items		**35.71**
Category		**Very Low**

Regarding question analysis, in the C4 dimension (Analyzing), the lowest score is number 4. In this case, the ability to analyze is low because students are not used to active discussions related to land subsidence phenomena that can cause flooding. For items, the highest score is related to the C4 dimension (Analyze), which is number 1, because students from primary education often discuss the factors regarding flooding to the present. This is because schools are the places most at risk of flooding. The impact of flooding on the school environment can

hinder the learning process, loss, damage, and even casualties. Flood countermeasures are essential as an effort to reduce the level of risk of loss, damage, and casualties (Dahlia & Fadiarman, 2020). In the C5 dimension (Evaluating), the lowest score is number 5. In this case, the ability to evaluate is low because the study of bio pores is rarely discussed in class. While the highest score in the C5 dimension (Evaluating) is number 7, related to the phenomenon of garbage that still exists in the school table, in this case, their evaluation ability is high because it is the act of some irresponsible students so that the evaluation of this phenomenon is high. In the C6 dimension (Making), the lowest score is number 10. This is because students' knowledge of government programs still lacks due to the lack of teaching materials/textbooks that spur their creativity to make a program. While the highest score in the C6 dimension (Making) is number 11, this is related to the creative ability of high vocational school students to invite the public to flood prevention programs because their knowledge is sufficiently mastered, so that in making the community participate, students are easy to do. This is because the problem-solving process is an integral part of learning.

The problem provides a structure of discovery that can help students learn more deeply and lead students to a broader understanding. This understanding is obtained by interacting with problems and the investigation process so that it will stimulate students to develop higher-order thinking skills. Students who have high creative thinking skills tend to feel challenged and interested in solving various problems in learning (Mardhiyana & Sejati, 2016). The research results indicated that the HOTS scores were relatively low. The HOTS scores confirmed this for each aspect (Table 4).

Table 4. HOTS Scores for Each Aspect

Aspect/Level	Average Score
Analyze	3.58
Evaluate	3.56
Create	3.57

It indicates that the vocational school students' ability to think and solve flood problems needs improvement. Various efforts can be carried out to improve the vocational school students' abilities to overcome their low HOTS. The efforts include the development of learning media in enhancing understanding of flood. Media in the form of instructional kits for mitigation for vocational education can be developed specifically for vocational school students. This can be done by teachers who teach science subjects at the vocational school. Science teachers need to focus on developing students' analytical and synthesizing skills about disaster mitigation. Therefore, they should give students proper tasks that would help them solve the problems, compare and contrast the elements based on characteristics, classify information to recognize the pattern and conclude the context (Rahman, 2019).

The novelty of this research, the media contains content that specifically discusses disasters and the high-level thinking skills of vocational school students about knowledge of these disasters. The Instructional kit for disaster mitigation developed must contain a variety of HOTS-related contents directed to solve flood problems. This is evidenced by research on media which has found that the development of media such as instructional kits can make students with low HOTS abilities higher. This indicates that the media can stimulate students' creativity in creating and designing objects that can solve problems. (Ichsan et al., 2020). Students are asked to analyze flood problems and then evaluate and create various solutions to the problems. It will directly improve HOTS (Hugerat & Kortam, 2014; Husamah et al., 2018;

Istiyono et al., 2018; Ramadhan et al., 2019). Students, however, must have an eagerness and strong motivation to study that will facilitate the improvement of the skills (Hsiao et al., 2016; Talmi et al., 2018).

There is a link between disaster mitigation and vocational high school students. The link is because vocational school students will work after they graduate. Therefore mitigation skills will be instrumental when a disaster hits their workplace. Moreover, the Instructional Kits for disaster mitigation must be based on the latest technology employed in learning. This is due to technology development that significantly influences the distribution of information related to natural disasters to students. The maximum use of technology will support learning implementation (Martin & Betrus, 2019; Rae, 2016).

CONCLUSION

The research resulted in that the HOTS score of the vocational school students was still low and required creative and innovative education related to disaster mitigation that supports the students' HOTS. Therefore, in future research, the researchers will develop an Instructional kit for Disaster mitigation as a medium to mitigate disaster to enhance vocational school students' HOTS.

REFERENCES

Azizah, K., Astuti, N., & Siswantoro, S. (2013). Pendekatan scientific bermuatan karakter siap siaga untuk meningkatkan keterampilan mitigasi. *Jurnal Pedagogi*, *1*(8).

Bakti, I., Hafiar, H., Budiana, H. R., & Puspitasari, L. (2017). Pemberdayaan pranata sosial melalui komunikasi lingkungan: Menakar pelibatan peran perempuan dalam mitigasi banjir citarum. *Kawistara*, *7*(1), 95–107.

Dahlia, S., & Fadiarman. (2020). Analisis risiko banjir terhadap fasilitas pendidikan di DKI Jakarta. *Jurnal Geografi Gea*, *20*(2), 185–196.

Hasan, A. (2019). The correlation of higher-order thinking skills and work readiness of vocational high school students. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *25*(1), 52–61. https://doi.org/10.21831/jptk.v25i1.19118

Hsiao, C. C., Tiao, M. M., & Chen, C. C. (2016). Using interactive multimedia e-books for learning blood cell morphology in pediatric hematology. *BMC Medical Education*, *16*(1), 290. https://doi.org/10.1186/s12909-016-0816-9

Hu, Q., & Zheng, Y. (2020). Smart city initiatives: A comparative study of American and Chinese cities. *Journal of Urban Affairs*, 1–22. https://doi.org/10.1080/07352166.2019.1694413

Hugerat, M., & Kortam, N. (2014). Improving higher-order thinking skills among freshmen by teaching science through inquiry. *Eurasia Journal of Mathematics, Science and Technology Education*, *10*(5), 447–454. https://doi.org/10.12973/eurasia.2014.1107a

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., Sigit, D. V., Miarsyah, M., Ali, A., Suwandi, T., & Titin. (2020). Implementation supplementary book of green consumerism: Improving students hots in environmental learning. *European Journal of Educational Research*, *9*(1), 227–237. https://doi.org/10.12973/eu-jer.9.1.227

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/eu-jer.7.3.555

Kamil, P. A., Utaya, S., & Utomo, D. H. (2020). Improving disaster knowledge within high school students through geographic literacy. *International Journal of Disaster Risk Reduction*, *43*, 101411.

Kurnia, R., & Fauzi, A. (2020). Knowledge analysis of students in disaster mitigation mount erupts. *Journal of Physics: Conference Series*, *1481*(1), 12137.

Mardhiyana, D., & Sejati, E. O. W. (2016). Mengembangkan kemampuan berpikir kreatif dan rasa ingin tahu melalui model pembelajaran berbasis masalah. *PRISMA, Prosiding Seminar Nasional Matematika*, *1*(1), 672–688.

Martin, F., & Betrus, A. K. (2019). Digital media for learning: Theories, processes, and solutions. In *Digital Media for Learning: Theories, Processes, and Solutions*. Springer. https://doi.org/10.1007/978-3-030-33120-7

Monfaredzadeh, T., & Berardi, U. (2015). Beneath the smart city: Dichotomy between sustainability and competitiveness. *International Journal of Sustainable Building Technology and Urban Development*, *6*(3), 140–156. https://doi.org/10.1080/2093761X.2015.1057875

Rae, A. (2016). Tales of disaster: The role of accident storytelling in safety teaching. *Cognition, Technology and Work*, *18*(1), 1–10. https://doi.org/10.1007/s10111-015-0341-3

Rahman, M. M. (2019). 21st century skill "problem solving": Defining the concept. *Asian Journal of Interdisciplinary Research*, *2*(1), 64–74. https://doi.org/10.34256/ajir1917

Rahmayanti, H., Ichsan, I. Z., Azwar, S. A., Purwandari, D. A., Pertiwi, N., Singh, C. K. S., & Gomes, P. W. P. (2020). DIFMOL: Indonesian students' Hots and environmental education model during COVID-19. *Journal of Sustainability Science and Management*, *15*(7), 10–19. https://doi.org/10.46754/jssm.2020.10.002

Ramadhan, S., Mardapi, D., Prasetyo, Z. K., & Utomo, H. B. (2019). The development of an instrument to measure the higher-order thinking skill in physics. *European Journal of Educational Research*, *8*(3), 743–751. https://doi.org/10.12973/eu-jer.8.3.743

Renald, A., Tjiptoherijanto, P., Suganda, E., & Djakapermana, R. D. (2016). Toward resilient and sustainable city adaptation model for flood disaster prone city: Case study of Jakarta capital region. *Procedia - Social and Behavioral Sciences*, *227*(November 2015), 334–340. https://doi.org/10.1016/j.sbspro.2016.06.079

Rusilowati, A., Binadja, A., & Mulyani, S. E. S. (2012). Mitigasi bencana alam berbasis pembelajaran bervisi science environment technology and society. *Jurnal Pendidikan Fisika Indonesia*, *8*(1).

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

Talmi, I., Hazzan, O., & Katz, R. (2018).

Intrinsic motivation and 21st-century skills in an undergraduate engineering project: The formula student project. *Higher Education Studies*, *8*(4), 46. https://doi.org/10.5539/hes.v8n4p46

Tkachuck, M. A., Schulenberg, S. E., & Lair, E. C. (2018). Natural disaster preparedness in college students: Implications for institutions of higher learning. *Journal of American College Health*, *66*(4), 269–279. https://doi.org/10.1080/07448481.2018.1431897

Utami, Y. G. D., & Hudaniyah. (2013). Self efficacy dengan kesiapan kerja siswa sekolah menengah kejuruan. *Jurnal Ilmiah Psikologi Terapan*, *1*(1), 40–52.

Xu, J., & Lu, Y. (2018). Towards an earthquake-resilient world: From post-disaster reconstruction to pre-disaster prevention. *Environmental Hazards*, *17*(4), 269–275. https://doi.org/10.1080/17477891.2018.1500878

Yedla, S., & Park, H. S. (2017). Eco-industrial networking for sustainable development: Review of issues and development strategies. *Clean Technologies and Environmental Policy*, *19*(2), 391–402. https://doi.org/10.1007/s10098-016-1224-x