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THE IMPLEMENTATION OF LOCAL CONTEXT MODULES AS AN EFFORT FOR DISASTER RISK REDUCTION (AN EMPIRICAL STUDY IN DISASTER-AFFECTED SCHOOLS)

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ABSTRACT

The frequent increase of natural disasters enforces the need for disaster risk reduction implementation in education. This empirical study aims to determine the effectiveness of the module in the context of the Palu disaster threat in understanding the process of the earthquake, tsunami, liquefaction, and mitigation. This research was conducted in schools that were directly affected by the disaster. For those affected by the liquefaction, the research was carried out at SMP 21 Petobo. Then for those who were affected by the tsunami, the research was conducted at SMP 10 Kampung Lere, Palu. The results show that the students of disaster-affected schools already had initial knowledge regarding Disaster Risk Reduction before the module was implemented. Social media, mass media, and disaster locations contributed to the formation of their initial understanding. This study result indicates that the normal gain value for each disaster subject in disaster-affected schools increases. However, the normal gain for each topic affected by liquefaction is higher. The average increase in the normal gain of implementing modules in the school affected by liquefaction was 21.76 percent, and in the school affected by the tsunami was 10.49 percent. The study concludes that understanding the local context disaster module is effective in disaster-affected schools and is more effective in schools that are heavily affected (liquefaction).

Keywords: disaster risk reduction; independent learning; Palu local context module

INTRODUCTION

An earthquake with a magnitude of 7.4 on the Richter scale struck Palu on September 28, 2018. The earthquake triggered a tsunami and liquefaction disaster. The earthquake and its aftermath caused damage to residential buildings, which amounted to 2,790 housing units, claimed 2113 lives, injured 4612 people, and 223,751 people have been displaced (BNPB, 2018). On January 15, 2021, another great earthquake hit Mamuju (BNPB, 2021). These frequent quakes are owing to the island of Sulawesi is traversed by many faults and is composed of a complex tectonic setting (Azizah et al., 2019). Accordingly, earthquake occurrence will highly happen again in Central Sulawesi in the future. However, the topic of potential tsunami and liquefaction for teaching materials has not been covered enough. It is because the issue of liquefaction has been rarely discussed in Palu, even in Indonesia.

Familiarizing children with disaster risk through education is one way to achieve disaster risk reduction (DRR) programs. Especially when the effects of climate change has triggered more natural disaster (McDonald-Harker et al., 2022). The attempt of communicating disaster information to children has been commenced since the early 90s, but it gets its momentum after the conference of DRR in Hyogo, Japan produced the Hyogo Framework for Action (HFA) (UNISDR, 2005). The emphasis on inserting DRR in educa-

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tion in HFA has attracted international attention to the significance of localizing DRR activities (Matsuoka et al., 2013). However, implementation of DRR at the local level is still limited (UNISDR, 2011), as the result of low coordination between stakeholders at the local and community level (Selby & Kagawa, 2012; Amri et al., 2017). This important component should not be missed since the localization of formulating DRR activities and education must be associated with local disaster potential and risks, and mitigation knowledge and skills based on local facilities and sources (Paton et al., 2010; Paton, 2013; Feng et al., 2018).

The effectiveness of embracing local disaster potential to DRR in education programs has been reported by many studies. "The miracle of Kamaishi" is one of the most inspiring stories of how associated local disasters in education can save the lives of children (e.g. (Matsuura & Shaw, 2015; Katada & Kanai, 2016; Oktari et al., 2018; Ohsumi et al., 2019). Furthermore, from the results of Kobe's research, the number of residents who survived the disaster due to self-help efforts amounted to 34.9%, and only about 1.7 percent of people survived because of assistance from the rescue team (BNPB, 2021). Accordingly, it is crucial to assure children get appropriate disaster risk information that is contextual, promoting self-help and protection, and self-learning.

In Indonesia, disaster mitigation learning has gone through formal education, including in the National Education System program with curriculum design from the National Education Standardization Agency. However, to further strengthen preparedness, a local contextual module is necessary because the weight and context of disaster threats in each region are different.

As one of the efforts in the field of education to reduce disaster risk, the researchers developed a disaster mitigation module in the local context of Palu, Central Sulawesi in Indonesia. With the intention of better understanding of local risks and disaster potentials, this module can hopefully guide students to study independently and be more aware and prepared for future disasters. Since a contextual learning module, requires a strong intrinsic motivation (Mynard, 2010), introducing and familiarizing children with their surroundings hopefully could trigger their interest and motivation to learn about DRR activities. This intrinsic motivation is especially regarding the high curiosity. It is curiosity about the process of the disaster and how to protect oneself from it. Curiosity grows because most students are the direct and indirect victims of disasters. Apart from curiosity, this contextual module can give us information on how to prepare and protect oneself from a disaster, since the motivation to survive a disaster is one of the most indispensable motivations (Figer, 2022). Therefore, the understanding of mitigation due to natural disasters will significantly increase.

The best self-motivation is intrinsic motivation. Intrinsically motivated students are at a greater level of understanding problems and can perform better (Trevino & DeFreitas, 2014). Students who receive special treatment by being given the modules have higher intrinsic motivation than students who receive conventional treatment (Mirkouei et al., 2016; Harefa & Silalahi, 2020). Motivation arises from exploring problems in the surrounding environment (contextual) and continuous creativity. Motivation can arise because the goals to be achieved are significant. Students find benefits for themselves by understanding and mastering new knowledge (Conley & French, 2014). This understanding is included in disaster mitigation knowledge.

The implementation of the module including the threat of local disasters issue is expected to encourage students' intrinsic motivation and increase students' curiosity. One intrinsic motivation is curiosity. Students' curiosity will encourage them to try to find the causes and the process of disaster occurrence so that their understanding of Disaster Risk Reduction and mitigation knowledge will increase (Lestari et al., 2021).

Students in disaster-affected locations mostly have tremendous trauma (King & Tarrant, 2013; Midtbust et al., 2018). Therefore, this learning module will facilitate the curiosity and desire of students who became survivors of disasters. This study aims to know students' initial abilities before implementing the module in disaster-affected schools, to see the link between the subtopics of the module discussion with the disasters that affected the school, and to analyse the effectiveness of implementing the disaster module in Palu, Central Sulawesi Indonesia context in disaster-affected schools.

METHODS

This research was conducted in schools affected by liquefaction, called SMPN 21 Petobo, and in schools affected by the Tsunami in SMPN 10 Kampung Lere. The research design used one group's Pretest posttest design. SMPN 21 Petobo is located 100 meters from the location of liquefaction. This school is located above the Gumbasa irrigation channel, so the building does not col-

lapse. However, this school was damaged by the 7.4 magnitude earthquake. Some of the students of SMPN 21 Petobo are survivors of the liquefaction. About 50 meters from the school, there is a temporary refuge camp for liquefaction victims.

SMPN 10 is located 50 meters from the shoreline of Talise. When the Tsunami occurred, SMPN 10 school building was hit and soaked by the devastating Tsunami. The school building is damaged but can still be used for learning. The Tsunami disaster occurred in the afternoon, so many students survived the disaster. However, around the school, there are traces of the Tsunami's impact, such as the buildings, hotels, cafes, and houses that have been destroyed. Until now, this school's location still includes the remaining damage from Tsunami.

The subjects of this study were 8th-grade students, including 21 and 17 people. The reason for choosing them as research subjects was because the 8th-grade students studied the topic of natural disasters contained in their Science subject matter. The changes that want to be measured are the changes in understanding the module's content before the module is given (pre-test) and after the module is given (post-test). This module contains material on earthquakes, liquefaction, and tsunami in the context of Palu. This research is part of Research and Development Research that uses a 4D model consisting of 4 phases: Define, Design, Development, and Disseminate. Before this module was implemented, validation by material and learning media experts were carried out. A materials expert is an expert in the field of earth physics. For media experts, validation was carried out by an expert staff of mitigation education media in BPBD (Regional Disaster Management Agency) Palu and a senior science teacher education practitioner. After experiencing repeated revisions and improvements to the module, the module has finally been declared suitable for school use (Wahyono, 2021). This research is part of a pilot study on schools directly affected by liquefaction and tsunami.

To see the effectiveness of understanding the module in disaster-affected schools, the formula developed by Hake (1998) is used.

$$g = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}} \; x \; 100\%$$

Equation (1)

Information:
S*post* : Final Test Score
S*pre* : Initial Test Score
S*maks* : Ideal Maximum Score

RESULTS AND DISCUSSION

The timing of the implementation of the module in schools affected by liquefaction and in schools affected by the tsunami was relatively the same. Before giving the module, a pretest was conducted to determine the students' initial abilities before applying the module. A brief description of the schools that became the research sample for the application of the module is presented in Table 1.

Table 1. Description of the Schools that Became the Research Sample

	Liquefaction		**Tsunami**	
Description	**Pretest**	**Posttest**	**Pre-test**	**Post-test**
Sample (n)	21	21	17	17
Minimum Score	3	12	7	11
Ideal	12	20	20	20
Maximum Score	20	20	16	20
Average score	6.71	16.95	12.24	15.82
Deviation Standard	2.57	2.40	2.73	2.63

While the pre-test and post-test scores in the application of the local context disaster module can be seen in Table 2. From Table 2, it can be seen that students in schools affected by liquefaction and tsunami, before implementing the module, already had prior knowledge. This is possible because of the impact of a powerful earthquake with a 7.4 on the Richter scale. Students seek new knowledge independently because liquefaction occurs, which is rarely discussed in learning at school as if liquefaction is a new type of disaster, and only Palu has experienced it. Liquefaction is the impact of a huge earthquake on loose soil types saturated with water. Liquefaction is actually not a new disaster, but due to a large earthquake, loose soil (sand) has changed the

terms ”walking house” and ”swapped garden” to become a cognitive burden. The expert did not predict that a tsunami in Palu would be as powerful and quick as that. This is because Palu Bay is unlikely to have a tremendous tsunami. After all, the Palu Koro Fault is a shear fault, and Palu Bay is not directly facing the wide ocean (Hariyanto, 2020).

Table 2. Pre-test and Post-test Scores in the Application of the Local Context Disaster Module

Name	S_{pre}	S_{post}	Name	S_{pre}	S_{post}
Affected by the Liquefaction			**Affected by the Tsunami**		
A	3	15	A1	7	12
B	4	13	B1	15	17
C	4	15	C1	16	20
D	4	16	D1	11	14
E	4	18	E1	14	16
F	5	12	F1	11	15
G	5	17	G1	14	20
H	5	16	H1	9	11
I	5	12	I1	15	18
J	6	17	J1	7	13
K	6	18	K1	13	15
L	7	18	L1	14	18
M	7	18	M1	14	19
N	7	17	N1	12	16
O	9	18	O1	10	14
P	9	19	P1	14	15
Q	9	19	Q1	12	16
R	10	19			
S	10	20			
T	10	19			
U	12	20			

Various mitigation literature says that one of the early warning signs of a potential Tsunami is the occurrence of a very large earthquake followed by the receding sea water. However, the tsunami event came faster, so the time to save ourselves was too short. According to Pakoksung et al. (2019), the Palu Tsunami occurred due to an underwater landslide. This new knowledge emerged in discussions and debates among disaster experts in the mainstream media, and on social media as well as in their daily conversations because they see the damage of liquefaction and tsunami every time. For months, the debris of liquefaction in affected villages became a spot for family visits, researchers, and tourists to discuss the causes of liquefaction and the tsunami. Local, national, and international mass media also discussed the massive impact of the Palu earthquake. On the other hand, students pass through the streets of post-earthquake damage every day. They were even living in temporary shelters for refugees, so students' initial knowledge was formed. After the module has been applied four times, the module with successive substances is given a post-test. The results of the post-test can be seen in Table 2.

It can be seen from the post-test results that not all students have a maximum score of 20. Some of them are still lacking. This might happen because students are not used to learning independently because it has not become their habit. This research was conducted when the COVID-19 pandemic hit the city of Palu at level 4, so students only met the teachers to collect assignments at school twice a week. So, this module has minimal teacher intervention. In this regard, Teacher-student interaction is essential, although modules appropriate to the context of the potential threat of the Palu disaster have been

developed. It can be concluded that this module still requires teacher intervention in its learning. However, learning will be more exciting and meaningful if the classroom is equipped with attractive teaching media in the context of threats to help teachers to increase students' interest in learning, such as comics, novels, videos, films, etc.

After testing the N gain from equation 1 in Table 2, the value of N is obtained in each school per material topic. It can be seen that in each topic in the application of the module, the value of N gain has increased. However, for each material topic at school that impacts liquefaction, the value of increase is higher. It could be because the students in schools affected by liquefaction experiencing higher psychological disorders such as anxiety, excessive fear, and mental disorders are higher (Masrukin, 2020). Understanding mitigation in the module aims to reduce or even eliminate disaster risks and impacts. Even though there has been an earthquake, the next earthquake has the potential to happen again. This result could be a suggestion for policymakers, researchers, academics, and related stakeholders to consider involving psychological aspects in DRR activities. It is either paying attention to children's state of psychology in post-disasters or integrating their "traumatic" experience as a motivation to reduce the effects of future disasters (Tanaka, 2005; Hayashi, 2016; Muzenda-Mudavanhu et al., 2016). Although further research and discussion are necessary regarding this issue.

Table 3. Gain Value by Subject

	Schools Affected by Liquefaction				Schools Affected by Tsunami		
No	**Subject**	**Pretest**	**Posttest**	**N gain**	**Pretest**	**Posttest**	**N gain**
1.	Mitigation	1,42	2,86	0,64	2.06	3,12	0,55
2.	Earthquake	2,09	5,24	0,83	4,06	5,06	0,36
3.	Tsunami	2,19	5,43	0,86	4,53	5,29	0,39
4.	liquefaction	1,28	3,48	0,83	1,59	2,35	0,21

Table 3 shows that students' understanding of each type of disaster has increased. The topic of discussion between schools affected by liquefaction and those affected by the Tsunami is not directly related. This may be because the two schools are still in the same city, only 10 km apart. The gain value for the schools affected by liquefaction is higher than for the schools affected by the tsunami. This may occur because the traumatic effect is more significant, and the liquefaction mitigation procedure is more complex. Mitigation of the Tsunami can be done by finding a higher place and away from the coastal area. Meanwhile, liquefaction mitigation is related to knowledge of geographical geological conditions. The practical experience of survivors of liquefaction victims depends on what they find at the time of the disaster (Wahyono & Astuti, 2021).

The result demonstrates that implementing the module could improve understanding of disaster mitigation. It is following previous studies that the application of disaster mitigation education is essential to improve student preparedness (Hayuditas, 2020; Novitasari, 2020; Shah, et al., 2020). Even short-term programs could possibly increase students' motivation to learn disaster knowledge and mitigation skills (Lin et al., 2013; Tsai et al., 2014; Tsai et al., 2015).

The module developed by Wahyono (2021) is a module in the context of the local Palu disaster. This module has several advantages, including the presentation of material that contains some information about the earthquake, tsunami, and liquefaction in the city of Palu, which occurred on September 28, 2018. Based on the statement of the language validator, the language used is easy to understand, and the teaching materials can be prepared so that students can learn independently. Based on the material expert's statement, the content of the teaching materials in the module is following the potential and occurrence of the disaster in Palu, it can be a reference material for students to know more about how to reduce disaster risk. This module also contains various examples of real images with explanations. Students need to learn from concrete experiences since it will make the learning process more meaningful than just mere imagination incidents (Tsai et al., 2014; Tsai et al., 2015). In terms of learning, this module has essential information that students must know. Furthermore, this module has provided case examples to measure

student competence after reading the module that includes in the form of quizzes and practice questions that students can do. At the end of the module, an answer key is provided for multiple choice practice questions and assignments.

The disaster module with the local context of Palu was designed by considering the needs of Palu city students in science physics lessons for SM children. The results of this research are also in line with the research module developed by Hasanah (2016) regarding disaster mitigation based on local potentials integrated into science lessons. This module is used to develop environmental awareness and minimize human-caused disasters.

The modules are designed to enable students to study independently. This disaster mitigation module contains materials, sample questions, practice assignments, and evaluations. Thus, in learning activities, the teacher can indirectly measure students understanding of the material studied. This module learning is expected to foster students' motivation and interest so that they feel interested in the material and need this knowledge because they have previously experienced a disaster. In this study, the focus is not on the test score. The main goal is for students to learn about disaster mitigation and how to save themselves from disasters. The topics cover how to act and anticipate potential disasters. Based on the results, this module is promising for long-term implementation because of its relevance to the local characteristics and its convenience in implementation. Accordingly, this module becomes very important for students to learn.

CONCLUSION

The module in the local context of Palu, which was developed and implemented for schools affected by liquefaction and tsunami, can improve understanding of disaster mitigation. Students in schools affected by liquefaction experienced higher levels of understanding of each topic of discussion. They previously had prior knowledge of disaster mitigation. Learning with modules still needs teacher involvement to foster student motivation in learning. To further improve understanding, it is necessary to integrate mitigation learning with teaching media that can help teachers to increase students' interest in learning, such as comics, novels, videos, films, etc.

REFERENCES

Amri, A., Bird, D. K., Ronan, K., Haynes, K., & Towers, B. (2017). Disaster risk reduction education in Indonesia: challenges and recommendations for scaling up. *Natural Hazards and Earth System Sciences*, *17*(4), 595-612.

Azizah, L. N., Tjahjono, A., & Sabtaji, A. (2019). Relokasi Hiposenter Gempa Bumi dan Model Struktur Kecepatan 1 Dimensi Gelombang P dengan Menggunakan Metode Coupled Velocity–Hypocenter Di Daerah Sulawesi Tengah dan Sekitarnya. *Jurnal AL-FIZIYA*, *2*(1).

BNPB. (2018). Kerugian dan Kerusakan Dampak Bencana di Sulawesi Tengah MencapaiI 13,82 Trilyun Rupiah. Available at: https://bnpb.go.id/berita/kerugian-dan-kerusakan-dampak-bencana-di-sulawesi-tengah-mencapai-1382-trilyun-rupiah [Accessed 23 October 2021].

BNPB. (2021). Gempa M 5,8 Guncang Kabupaten Mamuju. Available at: https://bnpb.go.id/berita/gempa-m-5-8-guncang-kabupaten-mamuju [Accessed 16 January 2022].

Conley, D. T., & French, E. M. (2014). Student ownership of learning as a key component of college readiness. *American Behavioral Scientist*, *58*(8), 1018-1034.

Feng, S., Hossain, L., & Paton, D. (2018). Harnessing informal education for community resilience. *Disaster Prevention and Management*, *27*(1), 43-59.

Figer, R. C. (2022). Surviving the 3/11 Disaster: Reflections of the Great East Japan Earthquake among Older Adults in Iwate Japan. *Journal of Community Development Research (Humanities and Social Sciences)*, *15*(1), 76-87. (1), 76-87.

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American journal of Physics*, *66*(1), 64-74.

Harefa, N., & Silalahi, N. F. D. (2020). Improvement of student's learning outcomes and motivation with chemical practicum e-module. *Jurnal Pendidikan Kimia*, *12*(1), 10-19.

Hariyanto, I. H. (2020). *Analisis Ketinggian Gelombang Tsunami Akibat Submarine Landslide (Studi Kasus: Teluk Palu, Sulawesi Tengah)* (Doctoral dissertation, Institut Teknologi Sepuluh Nopember).

Hasanah, I., & Wahyuni, S. (2016). Pengembangan Modul Mitigasi Bencana berbasis Potensi Lokal yang terintegrasi dalam pelajaran IPA di SMP. *Jurnal Pembelajaran Fisika*, *5*(3), 226-234.

Hayashi, I. (2016). Museums as hubs for disaster recovery and rebuilding communities. In *New Horizons for Asian Museums and Museology* (pp. 165-176). Springer, Singapore.

Hayudityas, B. (2020). Pentingnya penerapan pendidikan mitigasi bencana di Sekolah untuk mengetahui kesiapsiagaan peserta didik. *Jurnal Edukasi Nonformal*, *1*(1), 94-102.

Katada, T., & Kanai, M. (2016). The school education to improve the disaster response capacity: A case of "Kamaishi Miracle". *Journal of disaster research*, *11*(5), 845-856.

King, T. A., & Tarrant, R. A. (2013). Children's knowledge, cognitions and emotions surrounding natural disasters: An investigation of year 5 students, Wellington, New Zealand.

King, T. A., & Tarrant, R. A. C. (2013). Children's knowledge, cognitions and emotions surrounding natural disasters: an investigation of year 5 students, Wellington, New Zealand. *Australasian Journal of Disaster and Trauma Studies*, *2013*(1), 17-26.

Lestari, R., Haryono, T., & Erman, E. (2021). Using Comic-Based Socio-Scientific Issues in inquiry learning to increase interest and achievement in science learning. Thabiea*: Journal of Natural Science Teaching, 4*(1), 62-81.

Lin, S. C., Tsai, M. H., Chang, Y. L., & Kang, S. C. (2013). Game-initiated learning: a case study for disaster education research in Taiwan. In *2013 AAAI Spring Symposium Series*.

Masrukin, M. (2020). *Dampak Psikologis Akibat Bencana Alam Pada Peserta Didik Di SDN Inpres Jono Oge Kecamatan Sigi Biromaru Kabupaten Sigi* (Doctoral dissertation, IAIN Palu).

Matsuoka, Y., Takeuchi, Y., & Shaw, R. (2013). Implementation of hyogo framework for action in Makati City, Philippines. *International Journal of Disaster Resilience in the Built Environment, 4*(1), 23-42.

Matsuura, S., & Shaw, R. (2015). Exploring the possibilities of school-based recovery and community building in Toni District, Kamaishi. *Natural Hazards*, *75*(1), 613-633.

McDonald-Harker, C., Bassi, E. M., & Haney, T. J. (2022). "We Need to Do Something About This": Children and Youth's Post-Disaster Views on Climate Change and Environmental Crisis. *Sociological Inquiry*, *92*(1), 5-33.

Midtbust, L. G. H., Dyregrov, A., & Djup, H. W. (2018). Communicating with children and adolescents about the risk of natural disasters. *European journal of psychotraumatology*, *9*(sup2), 1429771.

Muzenda-Mudavanhu, C., Manyena, B., & Collins, A. E. (2016). Disaster risk reduction knowledge among children in Muzarabani District, Zimbabwe. *Natural Hazards*, *84*(2), 911-931.

Mynard, J. (2010, December). Promoting cognitive and metacognitive awareness through self-study modules: An investigation into advisor comments. In Proceedings of the International Conference CLaSIC 2010 "Individual Characteristics and Subjective Variables in Language Learning", Singapore (pp. 610-627).

Novitasari, A., Junda, M., & Daud, F. (2020). *Peningkatan Pemahaman, Sikap dan Motivasi Peserta Didik melalui Penerapan Modul Pelatihan Mitigasi Bencana Di SMP Negeri 1 Tanasitolo Kabupaten Wajo* (Doctoral dissertation, UNIVERSITAS NEGERI MAKASSAR).

Ohsumi, T., Dohi, Y., & Hazarika, H. (2019). Damage Related to the 2011 Tohoku Earthquake in and Around Kamaishi City–Beyond the Tsunami Disaster–. *Journal of Disaster Research*, *14*(9), 1185-1200.

Oktari, R. S., Shiwaku, K., Munadi, K., & Shaw, R. (2018). Enhancing community resilience towards disaster: The contributing factors of school-community collaborative network in the tsunami affected area in Aceh. *International Journal of Disaster Risk Reduction*, *29*, 3-12.

Pakoksung, K., Suppasri, A., Imamura, F., Athanasius, C., Omang, A., & Muhari, A. (2019). Simulation of the submarine landslide tsunami on 28 September 2018 in Palu Bay, Sulawesi Island, Indonesia, using a two-layer model. *Pure and Applied Geophysics*, *176*(8), 3323-3350.

Paton, D. (2013). Disaster Resilient Communities: Developing and testing an all-hazards theory. *Journal of Integrated Disaster Risk Management*, *3*(1), 1-17.

Paton, D., Sagala, S., Okada, N., Jang, L. J., Bürgelt, P. T., & Gregg, C. E. (2010). Making sense of natural hazard mitigation: Personal, social and cultural influences. *Environmental Hazards*, *9*(2), 183-196.

Selby, D., & Kagawa, F. (2012). Disaster risk reduction in school curricula: case studies from thirty countries.

Shah, A. A., Gong, Z., Pal, I., Sun, R., Ullah, W., & Wani, G. F. (2020). Disaster risk management insight on school emergency preparedness–a case study of Khyber Pakhtunkhwa, Pakistan. *International Journal of Disaster Risk Reduction*, *51*, 101805.

Tanaka, K. (2005). The impact of disaster education on public preparation and mitigation for earthquakes: a cross-country comparison between Fukui, Japan and the San Francisco Bay Area, California, USA. *Applied Geography*, *25*(3), 201-225.

Trevino, N. N., & DeFreitas, S. C. (2014). The relationship between intrinsic motivation and academic achievement for first generation Latino college students. *Social Psychology of Education*, *17*(2), 293-306.

Tsai, M. H., Chang, Y. L., Kao, C., & Kang, S. C. (2015). The effectiveness of a flood protection computer game for disaster education. *Visual-*

ization in Engineering, *3*(1), 1-13.

Tsai, M.-H., Wen, M.-C., Chang, Y.-L., & Kang, S.-C. (2014). Game-based education for disaster prevention. *Ai & Society*, *30*(4), 463-475.

UNISDR. (2005). *Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters* https://www.unisdr.org/files/1037_hyogoframeworkforactionenglish.pdf

UNISDR. (2011). *Hyogo framework for action 2005-2015 mid-term review*.

Wahyono, U. (2021) November). The Development of Local Disasters-based Mitigation Module Integrated to Physics Learning. In Journal of Physics: Conference Series (Vol. 2126, No. 1, p. 012020). IOP Publishing.

Wahyono, U., & Astuti, N. W. (2021, November). What we can learn from 2018 liquefaction in Central Sulawesi: Stories from the survivors. In *Journal of Physics: Conference Series* (Vol. 2126, No. 1, p. 012023). IOP Publishing.