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MECHANISM OF INCREASING PREPAREDNESS TSUNAMI: OMBAK - Learning Model Development

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ABSTRACT

People who live in tsunami disaster-prone areas need to be prepared to mitigate potential future risks. The present study aims in developing a learning model for tsunami mitigation in Indonesia. The model used for this study adopts an ADDIE approach - an acronym for Analysis, Design, Development, Implementation, and Evaluation. The analysis section of the report evaluates the learning needs of people who live in tsunami-prone locations. The subsequent design section of the report focuses in setting the creation of a new learning model regarding the mitigation of tsunami disaster impact and destruction. The development section addresses the required needs for the development of a tsunami mitigation learning model. The implementation section aims in applying and testing the developed model. Finally, the evaluation section assesses all of the activities of the developed model. The results of the study propose a new Tsunami learning model having four phases, abbreviated as "OMBAK".

Keywords: *Mitigation, Tsunami, Learning model, OMBAK, habituation.*

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INTRODUCTION

Indonesia is a fertile country with abundant natural resources, but located in the convergence zones of very active tectonic plates characterized by high seismic and volcanic activities which can generate additional destruction by tsunamis striking the extensive coasts of the country's numerous islands. Thus, the people in Indonesia are very vulnerable to natural disasters (Paripurno et al., 2019), but the death toll could be significantly reduced with proper education of potential disasters and adequate programs of preparedness. It is very important that the people in such threatened areas receive proper education in understanding these potential disasters and in developing skills to act responsibly before and after they strike (Tranto, 2010; Brunner & Lewis, 2006), so as to avoid or minimize the risk of becoming victims (Daud, et al., 2014).

A learning model for disaster alert needs to be developed and applied for the education of elementary school students to help them with their safety and resilience before, during, and after disasters stike. Based on past disasters that have occurred in Indonesia, such learning and training are needed to save the people when disasters strike, and for the way of avoiding accidents even in their daily lives. The main problem which people in Indonesia still face is the insuffienct level of disaster awareness. Lack of awareness can increase people's risk to disaster threats (Paripurno et al., 2019). Preliminary studies at the State University of Surabaya determined that there are still many people who are lacking in all aspects of disaster preparedness, especially in knowledge, attitudes, and post-disaster evacuation skills. Such lack of understanding on how to avoid or to mitigate the impact of disasters upon their lives, is the main reason for their vulnerability. Therefore, the present study aims to develop an innovative learning model to help improve disaster preparedness, especially for that of the tsunami hazard. Such disaster preparedness programs needs to be developed, starting at the level of basic education so as to build a safety and resilience culture, especially for children and young people.

Since many natural disasters and various other hazards occur frequently in Indonesia, early training is very much needed, which should include the right way for children and younger people to save themselves when disasters strike, and also avoid accidents in their daily lives. In general, the main problem is that the Indonesian people still do not have a sufficiently high level of awareness of the potential disasters that can strike their communities. Such lack of awareness increases community risks against potential disaster threats (Paripurno et al., 2019). This fact is reinforced by the results of preliminary studies conducted at Surabaya State University which indicate that there are still many people who are lacking in the aspects of disaster preparedness, especially of disaster knowledge, disaster response attitudes, and post-disaster evacuation skills. Therefore, there is a need for research with the main objective being the development of innovative learning models that can improve community disaster preparedness and particularly for tsunamis which, in recent years, have been very destructive and have caused many deaths.

The Model

With the above mentioned main objective, the present study concentrated in a program named the *Educational Design Research* (*EDR*). According to Akker et al., (2006), educational

design research is the systematic study of designing, developing, and evaluating training interventions as solutions for complex problems in educational practice, which also aim in advancing knowledge about the characteristics of these interventions, and about the processes of designing and developing them. The research objective of such training methodology is to produce a valid, practical, and effective OMBAK Learning Model to improve community disaster preparedness. Also this type of research produces learning education tools as an operational form of the OMBAK Learning Model, namely: Semester Implementation Plan (RPS), Learning Implementation Plan (RPP), Textbooks, Student Activity Sheets (LKS), Learning Model Implementation Worksheet (LKMP), Preparedness Assessment Instrument Disasters (IPKB), and Student Response Questionnaire (ARM).

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Learning model, OMBAK

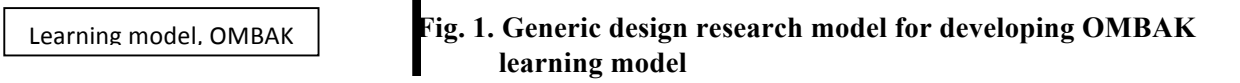

Fig. 1. Generic design research model for developing OMBAK learning model

The preparation of the OMBAK Learning Model refers to the Generic Design Research Model, according to Wademan. The steps of GDRM [8] are 1) identification of problems, 2) identification of product principles and designs tentatively, 3) theories and products temporarily, 4) making prototypes and valuing products, and 5) improving product quality. Stage of developing hypothetical learning models by modifying the generic design research model (Wademan, 2005) - presented in Fig. 1.

There are three school locations (communities) that are potentially prone to the tsunami hazard Tsunami, which are considered by the present study. First, the school community at Junior High School 2 Besuki, Bedsole village, in the Tulung Agung district. The distance from the school to Sidem beach is about 7 km. Second, the school community at Junior High School 2 Panggungrejo, Serang village, at Blitar district. The distance from the school to the beach is about 5 km. Third, the school community at Junior High School 3 Bantur, Sumberbening village, in the Malang district. The distance from the school to Balekambang beach is around 8 km. The school community referred to in this study are people within the school area consisting of a principal, two teachers, thirty-five students, one security guard, one guardian of the school, and one guardian of the canteen, so the total respondents for the three schools are 123 people.

RESULTS AND DISCUSSION

1. The OMBAK Learning Model

The tsunami mitigation-learning model that has been developed has four phases, namely Orientation, Understanding the concept of tsunami mitigation, Acting evacuation, and Correction (Evaluation). These four learning phases are called OMBAK. The following details the **OMBAK** learning model:

Table 1. Theoretical and Empirical Support from the Syntax of the OMBAK Learning Model

Theoretical Support	Empirical Support	Learning Activity	Learning Access Indicators
1. ARCS Theory (Attention, Relevance, Confidence, and Satisfaction) in order to raise curiosity and interest in learning, students must pay attention (Keller, 2010). 2. Attention (Bandura, 1977), students must pay attention to the model that will be used as a model in the learning process (Moreno, 2010). Students are intrinsically motivated through experiences that involve imagination and creativity (Eggen & Kauchak, 2013). 3. Using or changing previous knowledge and skills into creative products requires complex cognitive processes (Moreno, 2010; Eggen & Kauchak, 2013).	1. Teachers must be able to have a positive effect on student motivation in learning (Jones, Epler, Mokri, Bryant, & Paretti, 2013; Jones & Vall, 2014). 2. The results of the study indicate that motivation can have an effect on success in individuals (OECD, 2013). 3. The need for proper conditioning and preliminary preparation of student learning styles, self-efficacy, and intrinsic academic motivation in the learning process (Bembenutty, Cleary, & Kitsantas, 2013; Zimmerman & Schunk, 2008). 4. The government should always carry out disaster preparedness activities (Abidin, Bachri, Laksono, & Afandi, 2018). Disaster	**Phase 1: Orientation (O)** aims to attract student interest, focus student attention, and motivate them to play an active role in the learning process. In this phase, the virtual lab application on disaster preparedness plays an important role in the success of phases 2, 3, and 4 because the ability of lecturers to use the virtual lab application will facilitate classroom management so the students are more motivated and interactive in learning. In addition, students have been directed to understand the problems that will be solved to improve disaster preparedness.	The community is motivated in tsunami disaster preparedness

Theoretical Support	Empirical Support	Learning Activity	Learning Access Indicators
4. Advanced organizers: Directing students can help students to combine new information (Slavin, 2011). 5. Primacy effect; The Primacy effect; The tendency for items that appear at the beginning of a list is easier to remember than other items (Slavin, 2011).	preparedness activities are not specifically programmed but merely information. The areas on the banks or in the area around the river have disaster preparedness, especially mental recovery during and after disasters (Abidin, Bachri, Laksono, & Afandi, 2018).		
6. The cognitive constructivist theory by Piaget (1954, 1963), each participant is actively involved in the process of information acquisition and construction of their own knowledge (Arends, 2012). 7. Vygotsky's social constructivist theory has two implications surrounding the theory of social learning and the Zone of Proximal Development (Slavin, 2011). 8. Level of information processing, people, will handle stimuli at different levels of mental processing and will store information that has been managed through the most serious and deep processing (Slavin, 2011).	5. Authentic and meaningful problems that students find as a starting point for acquiring new knowledge (Batdi, 2014; Ibrahim, 2012; Imafuku, Kataoka, Mayahara, Suzuki, & Saiki, 2014; Stalker, Cullen, & Kloesel, 2014; Temel, 2014). 6. The government should always carry out disaster preparedness activities (Abidin, Bachri, Laksono, & Afandi, 2018). Disaster preparedness activities are not specifically programmed but merely information. The areas on the banks or in the area around the river have disaster preparedness, especially mental recovery during and after disasters (Abidin, Bachri, Laksono, & Afandi, 2018).	**Phase 2: (M)emahami (to understand)** Conceptual learning is needed to provide basic knowledge about the disaster. This basic knowledge of disaster includes knowledge of potential disaster threats, vulnerabilities, capacities, and disaster risks.	Disaster Preparedness: Communities understand tsunami disaster knowledge

Theoretical Support	Empirical Support	Learning Activity	Learning Access Indicators
9. Retention, students must do repetition so that their procedural knowledge can be remembered (Moreno, 2010).			
10. Cognitive distribution theory: Conveying ideas to others can improve their own understanding (Moreno, 2010). 11.The dual coding theory, the information presented visually and verbally, is remembered better than information that is only presented in one way (Slavin, 2011). 12.The level of information processing, people, will handle stimuli at different levels of mental processing and will store information that has been managed through the most serious and deep processing (Slavin, 2011). 13.Cognitive apprenticeship; the process when a student reaches expertise in his interaction with an expert (Slavin, 2011). 14.Positive interdependence, students need to have a positive dependence to achieve success in the process of collaborative problem	7. The results of previous studies show that students who process information seriously have better memories than those who do not (Slavin, 2011). 8. Lack of opportunities to give realistic feedback on the quality of ideas generated, this reduces student motivation and inhibits student confidence in solving problems (Munro, 2011). 9. In line with Pratiwi and Prihatiningsih (2016), with the results of the study, there is an influence of earthquake disaster management training to improve disaster preparedness. 10. Results of Havwina, Maryani, and Nandi (2016) research that experience significantly influences students' readiness with positive coefficients, which means that the higher value of disaster experience variable, the better preparedness.	**Phase 3: (B) ertind (A) k (to act)** Action is practical learning that is intended for students can have skills in the disaster, include preparedness, emergency, and recovery exercises, as well as preparing disaster management plans and contingency plans. At this stage, students are also expected to be able to apply their disaster management capabilities, both on-campus and off-campus. The outcome of the disaster learning process that is followed by these students is the profile of graduates who are knowledgeable about disaster risk reduction. After learning the practice, it is hoped that students will have a strong attitude in dealing with disasters.	Disaster Preparedness: People act correctly in the face of the tsunami disaster

Theoretical Support	Empirical Support	Learning Activity	Learning Access Indicators
solving (Moreno, 2010).			
15. *Motivation* (Bandura, 1977) students need further practice to rich more motivation (Moreno, 2010). 16. *Self-evaluation,* students must be able to evaluate the process and results of scientific creativity and collaboration as a reflection for further action (Moreno, 2010). 17. The final effect, the tendency for items that appear at the end, is easier to remember than other items (Slavin, 2011).	11. Evaluation of ideas and other thoughts can improve problem-solving abilities (Gregory, Hardiman, Yarmolinskaya, Rinne, & Limb, 2013). 12. The need for teacher evaluations of the inquiry process and problem solving of students is an important component, with no feedback gained little knowledge (Arends, 2012). 13. It can be found in public places, agencies, institutions, and so on (Utami & Nanda, 2018).	**Phase 4: (K)oreksi (to correct / to evaluate)** aims to evaluate the disaster preparedness of prospective teachers and prepare follow-up. Lecturers involve students in evaluating tsunami preparedness for the community. The instructor directs the community to prepare everything for the next meeting.	The community has Tsunami Disaster Preparedness

2. The effectiveness of the OMBAK learning model

To describe the effectiveness of the OMBAK learning model, it was tested at three schools using a qualitative approach. The qualitative approach includes: 1) Planning: plan what actions are carried out to improve, enhance, and change school communities' attitudes as a solution, 2) Application: The effort made by the researchers in term of improvement, enhancement, and desired change, 3) Observation: Observe the effect of OMBAK on students' response in the class, and 4) Reflection: Review and consider the influence of various criteria.

Data was collected using a questionnaire to measure understanding, attitude, preparedness action, and school communities' response to the learning model used. Moreover, the observation sheet was administered to collect additional data in terms of disaster readiness. Qualitative data were analyzed by following Moleong's (2007) technique, namely: 1) Analyzing all available data from various sources (interviews, observations, pictures, videos, and others); 2) Conducting data reduction by means of abstraction (making summaries and statements focus on the aims of research); 3) Selecting and grouping data based on information which has been compiled, and 4) Conducting data validation before drawing conclusions of the study. Moreover, quantitative data were analyzed by using a percentage formula (Sugiyono, 2013):

$$P_n = f/Nx\ 100\% \quad \ldots\ldots (1)$$

P_n = Success percentage of supporting factors (n=1: Understanding, n=2: Attitude, n=3: Preparadness action); f = Total score obtained by each factor; N= Maximum score for each factor.

In general, knowledge of disaster readiness is good. It was found that school communities' understanding increase from 75% to 95% in cycle II. Therefore, it was concluded that OMBAK learning model is effective in improving Indonesian disaster readiness. It is expected that this learning model could decrease the risk of disasters, such as Tsunami and earthquake, as the most happened disasters in Indonesia. See the percentage of their understanding in Fig. 2.

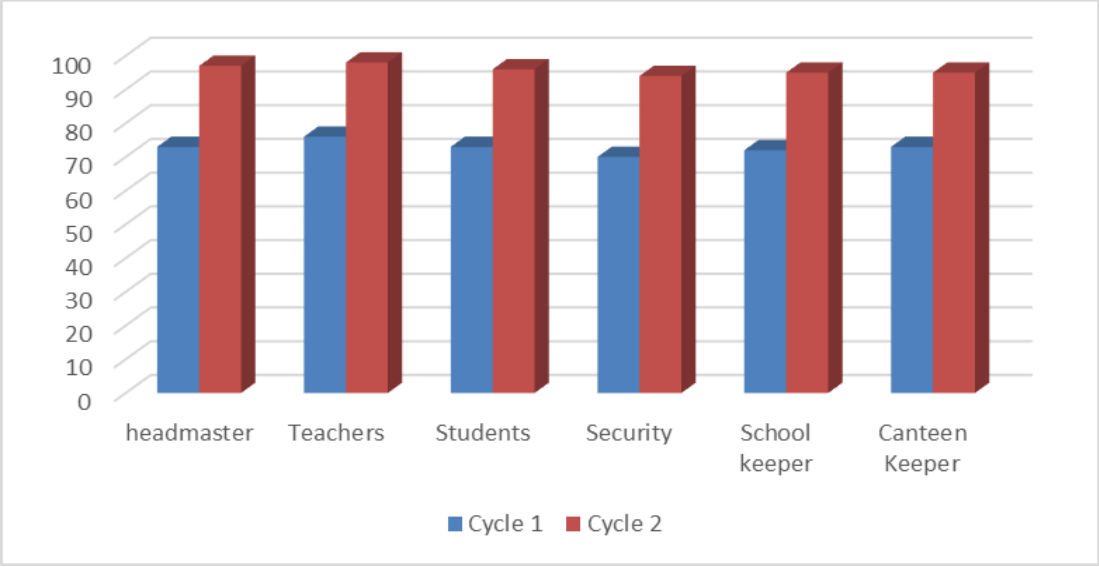

Figure 2. Comparison of subject's understanding in Cycle I and Cycle II

This result was supported by prior studies of Pribadi and Yuliawati (2009), Daud, et al. (2014), Madlazim and Supriyono 201), and Madlazim et al (2020), in which there was an increase of students' and parents' understanding after they applied the disaster preparedness educational subject. Conceptual understanding and attitude correlate with each other. With the knowledge of disaster preparedness, it will affect human attitude when a disaster occurs. In addition, attitudes based on knowledge can be utilized in the long run.

For the attitude aspect in facing the disasters, it was found that the participants' attitude varies from very appropriate to good. It was shown by their percentage increases from 74.3% (cycle I) to 96.8% (cycle II). A comparison of answers' percentages in each school can be seen in Fig. 3.

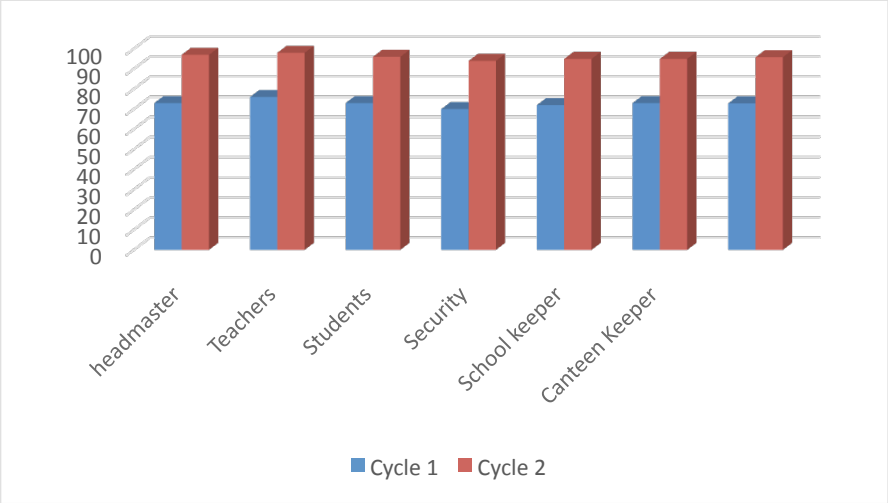

Figure 3. Comparison of school communities' attitude in cycle I and cycle II

A previous study concluded that understanding, attitude, and family support significantly affect disaster preparedness (Lenawida, 2011), and attitude is the main factor. The school communities' attitude increases by up to 23% (72.8% to 95.8% in cycle I and cycle II, respectively). The percentage comparison of each school community can be seen in Fig. 4.

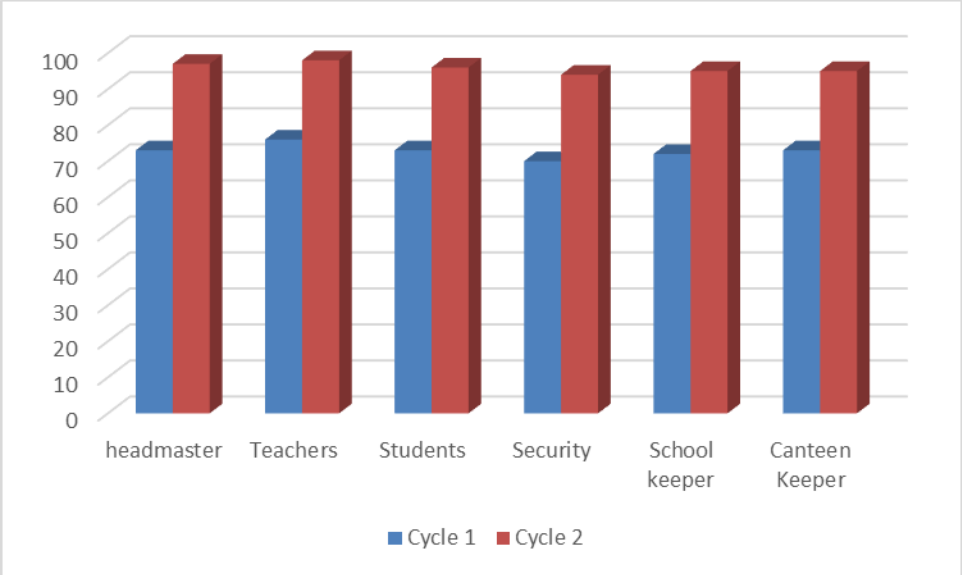

Figure 4. Comparison of school communities' attitude in cycle I and cycle II

Khairuddin et al. (2012), Madlazim and Supriyono 201), and Madlazim et al (2020) investigated the society's disaster preparedness and found that their preparedness in reducing the risk of disaster is still at the level of knowing rescue, but they do not yet have the skills for preparedness actions.

CONCLUSIONS

It has developed the OMBAK learning model, including 4 phases, that is orientation, understanding, action, and evaluation. This model is effective to significantly increase conceptual understanding, attitude, and response to mitigation.

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REFERENCES

Akker, van den, J. J. H., Gravemeijer, K. P. E., McKenney, S., & Nieveen, N. M. (Eds.) (2006). *Educational design research*. London: Routledge Taylor & Francis Group.

Abidin, Z., Bachri, A., Laksono, A.B., & Afandi. (2018). Mitigasi Bencana Dan Sosialisasi Perawatan Tanggul Desa Tegalsari Kec.Widang Kab. Tuban. *MATAPPA: Jurnal Pengabdian Kepada Masyarakat*, *1*(2), 1-6.

Arends, R. (2012). *Learning to teach*. New York: McGraw-Hill.

Brunner, J. and Lewis, D. (2006). Planning for Emergencies. *Principal leadership*. April 2006. 6; 8 : p. 65-66.

Bandura, A. (1977). Self-efficacy: Toward unifying theory of behavioral change. *Psychological Review*, *84*(2), 191-215.

Batdi, V. (2014). The effects of problem based learning approach on students' attitude levels: A meta-analysis. *Educational Research and Reviews*, *9*(9), 272-276.

Bembenutty, H., Cleary, T., & Kitsantas, A., (2013). Applications of self-regulated learning applied across diverse disciplines: A tribute to Barry J. Zimmerman. Charlotte, NC: Information Age Publishing.

Eggen, P. D. & Kauchak, D. P. (2013). *Educational psychology:* Windows on clasrooms (9th edition). New Jersey: Pearson.

Daud, R, Sari, S. A., Milfayetty, S., & Dirhamsyah, M. (2014). PENERAPAN PELATIHAN SIAGA BENCANA, *1*(1), 26-34.

Gregory, E., Hardiman, M., Yarmolinskaya, J., Rinne, L., & Limb, C. (2013). Building creative thinking in the classroom: From research to practice. *International Journal of Educational Research, 62*, 43-50.

Havwina, T., Maryani, E., & Nandi (2016). Pengaruh pengalaman bencana terhadapkesiapsiagaan peserta didik dalam menghadapi ancaman gempabumi dan tsunami. *Jurnal Pendidikan Geografi*, *16*(2).

Ibrahim, M. (2012). *Pembelajaran berdasarkan masalah*. Surabaya: Unesa University Press.

Imafuku, R., Kataoka, R., Mayahara, M., Suzuki, H., & Saiki, T. (2014). Students' experiences in interdisciplinary problem-based learning: A discourse analysis of group interaction. *Interdisciplinary Journal of Problem-based Learning*, *8*(2), 1-19.

Jones, B. D., Epler, C. M., Mokri, P., Bryant, L. H., & Paretti, M. C. (2013). The effects of a collaborative problem-based learning experience on students' motivation in engineering capstone courses. *Interdisciplinary Journal of Problem-Based Learnin*g, *7* (2).

Jones, H. M. B. & Vall, O. C. (2014). Preparing special educators for collaboration in the classroom: Pre service teachers' beliefs and perspectives. *International Journal of Special Education*, *29*(1), 1-12.

Keller, M. J. (2010). *Motivational Design for Learning and Performance the ARCS Model Approach*. USA: Springer.

Khairudin, dkk. Dampak Pelatihan Pengurangan Risiko Bencana terhadap Kesiapsiagaan Komunitas Sekolah. *Prosiding Seminar Hasil Penelitian Kebencanaan TDMRC-Un syiah, Banda Aceh, 13-19 April 2011*. Banda Aceh: Universitas Syiah Kuala.

Lenawida. 2011. *PengaruhPengetahuan, Sikap, danDukunganAnggotaKeluargaTerhadapKesiapsiagaanRumahTanggadalamMenghadapi BencanaGempaBumi di DesaDeyah Raya KecamatanSyiah Kuala Kota Banda Aceh.* TesisUniversitasNegeri Medan.

Madlazim, Rahmadiarti, F., Masriyah,Indana, S., Sunarti, T., Prahani, B.K. (2020). An OrSAEv learning model to improve the disaster preparedness of STEM teacher candidates. *World Transactions on Engineering and Technology Education* 18 (2), pp.231.

Madlazim, and Supriyono (2014). Improving experiment design skills: Using the Joko Tingkir program as a learning tool of Tsunami topic. *Science of Tsunami Hazards* 33 (2) ,pp.133.

Moleong, L. J. 2007. *Metodologi Penelitian Kualitatif*. Bandung: Rosda.

Moreno, R. (2010). *Educational Psychology*. New York: Jhon Wiley & Sonc, Inc.

Munro. *Penyuluhan (Conseling) Suatu pendekatan Berdasarkan Keterampilan*, Ghalia Indonesia, Jakarta : 1983.

OECD. (2013). *PISA 2015 Collaborative Problem Solving Framework*. New York: OECD Publishing.

Paripurno, E. T., Munadi, K., Kusuma, S., Ismail, N., & Mardiatmo, D. (2019). Pembelajaran kebencanaan untuk mahasiswa di perguruan tinggi.

Pratiwi, E. & Prihatiningsih, D. (2016). Pengaruh Pelatihan Penanggulangan Bencana Gempa Bumi Terhadap Kesiapsiagaan Palang Merah Remaja (PMR) SMAN 1 Pleret Bantul Dalam Menghadapi Bencana. (Tesis) Universitas 'Aisyiyah Yogyakarta

Pribadi, K. dan Yuliawati, A. K. 2009. Pendidikan Siaga Bencana Gempa Bumi Sebagai Upaya Meningkatkan Keselamatan Siswa (Studi Kasus pada SDN Cirateun dan SDN Padasuka 2 Kabupaten Bandung). *Jurnal PendidikanTahun 9 Nomor 9*, Oktober 2009.

Slavin, E. R. (2011). *Educational psychology: Theory and practice.* Boston: Pearson.

Stalker, S. L., Cullen, T., & Kloesel, K. (2014). Using PBM to prepare educators and emergency managers to plan for severe weather. *Interdisciplinary Journal of Problem-Based Learning*.

Sugiyono. 2013. *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D.* Bandung: ALFABETA.

Temel, S. (2014). The effects of problems based learning on pre service teacher's critical thinking dispositions and perceptions of problems solving ability. *South African Journal of Education*, *34*(1), 1-20.

Trianto. 2010. *Model Pembelajaran Inovatif Berorientasi Konstrutivistik.* Surabaya: Pustaka Ilmu.

Utami, T.N. & Meutia Nanda, M. (2018). Pengaruh pelatihan bencana dan keselamatan kerja terhadap respons persepsi mahasiswa prodi ilmu kesehatan masyarakat. *Jurnal JUMANTIK*, *4*(1), 84-100.

Wademan, M.R. (2005). *Utilizing development research to guide people-capability maturity model adoption considerations.* Doctoral dissertation. Syracuse: Syracuse University. Dissertation Abstracts International, 67-01A, 434. (UMI No. 3205587)
9(2), 1-9.

Zimmerman, B. J. & Schunk, D. H. (2008). Motivation: An essential dimension of self-regulated learning. In D. H. Schunk & B. J. Zimmerman (Eds.), Motivation and self-regulated learning: Theory, research, and applications (pp. 1–30). Mahwah, NJ: Lawrence Erlbaum Associates.