ISSN 2964-4291
https://proceeding.unnes.ac.id/index.php/iset

Analysis of Disaster Education Models: Studies from Early Childhood to Higher Education Levels

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Abstract. Disaster education is a mandatory effort to deal with unexpected natural disasters. Disaster education trains knowledge, attitudes, and skills in dealing with disasters, one of which can be done through formal education, starting from early childhood to tertiary education. This writing aims to analyze the model of implementing disaster education through formal education, starting from early childhood education, elementary school, and middle school, to university. This article systematically uses the type of literature review writing by reviewing as many as 53 articles in Scopus-indexed journals and proceedings. The research results show different disaster education models at each level. The early childhood education level is taught with fun learning activities inside and outside the classroom, telling stories, and through websites. Elementary school level is carried out by camping, disaster drills, integrated with learning and local wisdom, implementing programs in schools, and optimizing smartphone functions. The secondary school level is conducted by conducting preparedness exercises, optimizing smartphones, applying specific learning methods, and integrating them with subjects. As for the tertiary level, this can be done by being involved in management, in natural disaster areas, and making disaster education a compulsory subject.

Keywords: disaster education model; school; student preparedness

INTRODUCTION

Natural disasters are a very powerful threat to human life and nature. Disasters cause humans to experience various negative impacts, such as material losses, damage to public facilities, physical and psychological health impacts, and loss of family and friends (Arifeen & Nyborg, 2021; Hallegatte, 2014). Disasters also have an impact on the sustainability of nature, which is shown by the destruction of various natural ecosystems due to the disaster. Abrasion, for example, will result in the destruction of mangrove forests on the coast so that there are no more mangrove plants whose basic function is to protect against waves (Feka & Ajonina, 2011; Joesidawati & Suwarsih, 2019). Abrasion will also erode the land on the coast so that the land decreases and the people's land become narrower. Apart from having an impact on humans, living things that live on the shoreline such as fish and various invertebrates will also lose their homes (Hamid et al., 2021; Naharuddin, 2021).

Knowledge about disasters is important for every human being to have (Asio, 2020). This knowledge is not only limited to people who live in disaster-prone areas such as Indonesia (Amri et al., 2017), but also in areas with a low level of disaster risk. This is due to the nature of humans who are mobile or often move from one area to another. Therefore, even if someone lives in an area with low disaster risk, knowledge about disasters must still be owned because perhaps the area visited will experience a disaster suddenly (Appleby-Arnold et al., 2018). When knowledge about disasters is possessed, a person will be better prepared to deal with disasters (Andrea & Michele, 2016). This is supported by Sujarwo et al. (2018) which states that knowledge about disasters plays a very important role in dealing with disasters, where the higher the knowledge about disasters, the higher the preparedness in dealing with disasters.

Character and skills in dealing with disasters must also be owned to reduce the negative impact of disasters (Lee & Lee, 2020; Lisnasari, 2018; Nuryana & Suyadi, 2019). The characters needed in dealing with disasters include being independent, namely so that people can save themselves as soon as possible without depending on the help of others (Anafiah & Rezkita, 2020); prepared, where the community

is able to try to save lives and property if a disaster occurs at any time (Al-Nashr, 2015); mutual help, namely so that people can help other people who need help (Gunardo, 2013; Subair et al., 2014); as well as various other characters. Skills in dealing with disasters such as skills to run and save oneself to the right and safe place are also skills that must be possessed so that the community can be prepared if a disaster occurs at any time (Juhadi et al., 2021). Attitudes and skills in dealing with disasters must be trained, so that whenever a disaster occurs, these characters and skills can be applied to deal with the disaster that occurs (Nagata, 2020; Zakaria et al., 2020).

Knowledge, character, and skills in dealing with disasters can be trained through formal education such as schools and universities (Darysyani, 2017). Formal education institutions are obliged to prepare students who are prepared to face disasters, both now and in the future (Luetz, 2019; Mendonca, 2017; Shaw, 2011). These competencies are trained through the implementation of disaster education (Nurani et al., 2020). Previous studies have shown various efforts to implement disaster education through formal education (Johnson et al., 2014; Katayama et al., 2021; Shaw et al., 2015). Based on searches using the Publish or perish application, it can be seen that the term "disaster education" has begun to be implemented, discussed in international scientific forums, and published in scientific research since the publication of an article entitled "Disaster Education, Household Preparedness, and Stress Responses Following Hurricane Hugo" by Faupel (1993).

Disaster education is a learning material that requires certain cognitive abilities to receive it. As with other learning, disaster education must also be adapted to the cognitive abilities of the recipients (Mangione et al., 2013; Sharpe & Izadkhah, 2014). Disaster education for early childhood will of course be different from disaster education for elementary, middle school, and even tertiary school children. Disaster education for early childhood is certainly the simplest, while at tertiary institutions which is the highest level of education, it is certainly the most complex. The process of delivering disaster education among students in elementary schools who in their learning process still require a lot of guidance is certainly different from students in tertiary institutions who are able to learn independently (Atmaja et al., 2021; Moriyama, 2014; Ozkazanc & Yuksel, 2015).

Review research on disaster education has been done before. Among them, namely by Johnson et al. (2014) who have conducted a review of the evaluation stage in disaster education. Aghaei et al. (2018) also conducted a review of disaster education, namely the strategies that can be used. Among the discussions are about approaches, materials, and tools in disaster education. In line with that, Subarno & Dewi (2022) also conducted a review in this field, but focused more on its forms, namely whether using games, discussions, drills, lectures, and so on. Even so, research has never been conducted that discusses in detail the implementation of disaster education through formal education, namely from Early Childhood Education to tertiary institutions.

Various previous studies have investigated the implementation of disaster education through formal education. Even so, from the various studies that have been conducted, there has never been a complete comparison of how disaster education is implemented through formal education at every level (Finnis et al., 2010; Shahidullah & Hossain, 2022; Tyas & Pujianto, 2020). Therefore, this research was conducted with the aim of analyzing the implementation of disaster education through formal education, starting from the level of early childhood education, elementary school, middle school, to university. This research will find out the models for implementing disaster education at each of these levels so that it can become a reference and choice for further researchers and practitioners in implementing disaster education in their agencies.

METHODS

This article uses the type of literature review writing. This type of writing is done by reviewing previous literature that is appropriate to the topic of discussion. The approach used is a systematic review because the keywords used are quite specific (Snyder, 2019). The literature analyzed in this study was Scopus indexed journal articles and conference papers. The reference acquisition technique in this article uses a literature study technique. The focus of his study is on models of implementing disaster education in schools from the references found, starting from the early childhood level, elementary schools, middle schools, to tertiary institutions.

The references analyzed in this study were obtained through the Publish or Perish (PoP) application using three keywords as shown in

Figure 1. The search was carried out in the Scopus database without filtering the year. The total references obtained from these three keywords are 371 references. Based on the references found, there are several references that are excluded, namely books, book chapters, letters, notes, and editorials. The selected references are in the form of journal articles and proceedings, both in the form of original research and reviews. Based on these exceptions, 22 references were excluded so that a total of 349 journal articles and proceedings were obtained. Furthermore, the re-election of articles according to the research topic was carried out to be further grouped by level of education. Until the final stage of filtering, 50 articles were obtained for analysis with clearer filtration process shown by Figure 1.

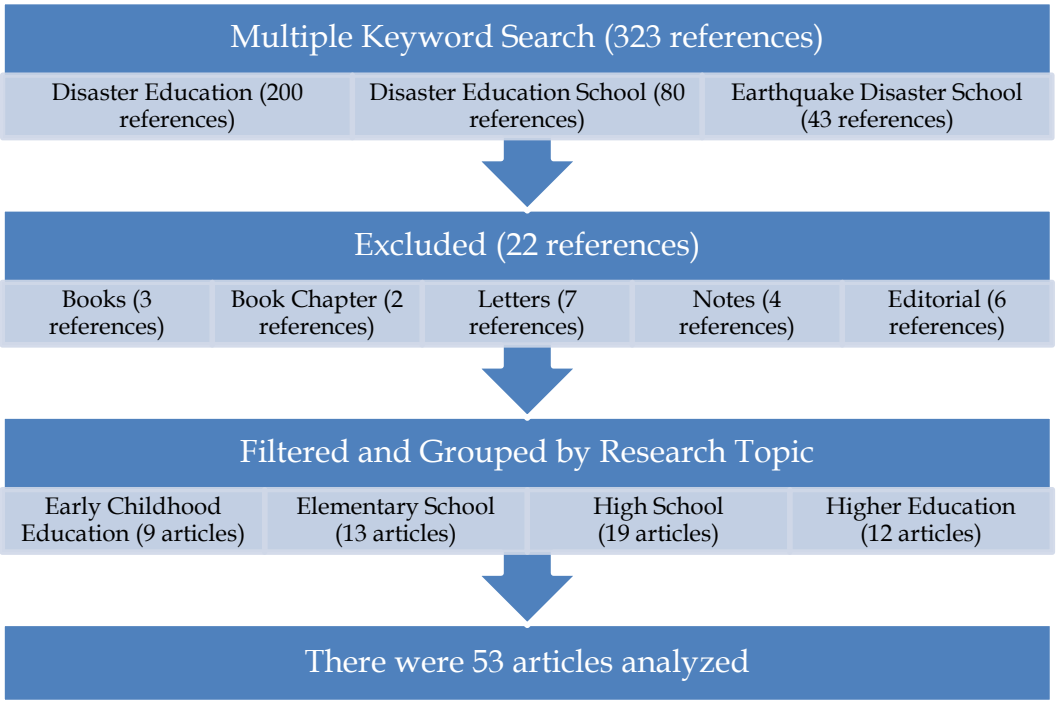

Figure 1. Article Selection Process

The analysis used in this study is content analysis as has been done by Lin et al. (2019). Content analysis is done by analyzing the contents of the references used. After being analyzed, materials that support the topic of discussion will then be taken. The material that does not support will be reduced. The results of the analysis are discussed in the discussion to be displayed later, either in the form of text, images, tables, to graphics. The findings in this study are that there are different models of disaster education at each level of education, where these models are adapted to the abilities of students.

RESULTS AND DISCUSSION

Disaster Education at the Early Childhood Education Level

Disaster education must be given to children from an early age. Disaster education at this level is adjusted to the activities carried out during the learning process. Learning is very dominated by a fun learning process. Among them are learning while playing, singing, drawing, practicing writing and reading, compiling puzzles, doing fun activities, to simple experiments and filed trips outside the classroom. Disaster learning can be adapted to these activities. These learning activities can be carried out together in a group so that good cooperation is established between students. Apart from the group learning model, other models can also be applied such as demonstrations, role playing, discussions, and exercises (Sharpe & Izadkhah, 2014).

Disaster education models can be carried out in various ways as shown in Figure 2. One model of disaster education that is often used at this level is through storytelling. The stories used can vary, from folk tales to modern children's stories. Folktales conveyed orally according to Fujii et al. (2021) is effective for delivering disaster education even in the modern era. Even so, technological developments have also allowed folklore to be digitized so that it can become an

attractive disaster education medium for students (Rahiem et al., 2020). This activity is not only carried out by the teacher but also actively by students. Students can be stimulated to tell about disaster events that have been experienced or sensed. Especially for students who experience and become victims of disasters, these activities can minimize the stress and trauma experienced by students and restore students' conditions (Bateman & Danby, 2013).

Figure 2. Disaster Education Model at the Early Childhood Education Level

Another model of disaster education at this level is through the website. The United States of America through the Federal Emergency Management Agency (FEMA) is a country that has developed three websites to study disaster for children as researched by Hilyard et al. (2011) namely Let's Get Ready, FEMA for Kids, and ReadyKids. This website is a pioneering website that initiates the formation of a disaster education website for children. The website contains various information about natural disasters and preparedness in dealing with them which is conveyed using cartoon characters and fairy tales. The delivery techniques also vary, ranging from the use of text, videos, quizzes, coloring pictures, crosswords, and games. Disaster material is packaged in a light and entertaining way for children. Even so, the website is also not free from criticism because it is considered not to follow technological developments, is less interactive, and pays less attention to pedagogical aspects (Erin et al., 2012).

The implementation of disaster education at the pre-school education level is still rarely carried out. Even so, actually the program is very urgent. Proulx & Aboud (2019) prove that this implementation is able to increase students' disaster knowledge and the quality of the pre-school environment. The integration of disaster education into the pre-school curriculum will build children's awareness of disaster vulnerability in their area and encourage children to be directly involved in disaster risk reduction, so that students will have good preparedness from an early age and will continue to be carried into adulthood.

Disaster education in early childhood is not only carried out by schools, but also must involve the family. The family is precisely the first education for children and the place where children spend the most time, so it is very important for families to instill disaster values from an early age. For the sake of introducing disaster literacy, for example, families, especially parents, can introduce children to a collection of books about disasters and invite children to read these books (Triyanto et al., 2021). Disaster education programs that are implemented in schools must also involve parents in their implementation. Gulay (2010) stated that programs involving parents were able to significantly increase students' disaster literacy compared to programs that did not involve parents.

Disaster Education at Elementary School Level

Disaster education at the elementary school level is important to do because learning at this time will determine the development of mindset and behavior in the future (Shujuan, 2014). There are at least five disaster education models at this level as shown in the Figure 3. The first model at this level is through the camp. Japan as a developed country in terms of disaster education provides disaster education in elementary schools as a form of training for conducting evaluations through camps with the theme of natural disaster prevention. The camp works with nursing students who voluntarily become mentors in these activities (Sakurai, 2022).

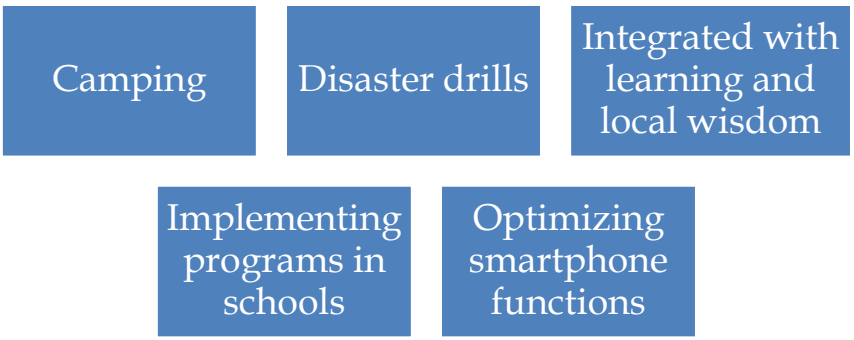

Figure 3. Disaster Education Model at the Elementary School Level

The second model is through disaster training. Iran, for example, has started providing disaster education to elementary school students since 1996. This activity is in the form of training entitled "Earthquake and Safety" School Drills which has been consistently carried out until now. Students will be taught about self-rescue and evacuation efforts through the program, and followed by disaster drills which are held on an annual scale. Since 2015, the program has been carried out by involving the participation of the local community so that a community that is resilient to natural disasters will be formed (Hosseini & Izadkhah, 2020). Disaster preparedness training is also in the form of physical exercise so that the body is strong in facing disasters. This physical health training can be carried out through physical education subjects which are integrated with disaster material (Nopembri et al., 2021). Students who have received training to improve physical health are known to have higher disaster preparedness than students who have not received this training (Saryono et al., 2021).

The third model is through the integration of disaster education with learning and local wisdom in the areas where students live. In addition to increasing disaster literacy, this learning model is also an introduction to local wisdom to the younger generation (Suarmika et al., 2022). Indonesian local wisdom that can be integrated with disasters includes the local wisdom "Smong" of the Simeulue tribe community, Aceh Province. This local wisdom is an early warning when there are signs of a tsunami disaster by shouting "Smong" so that people immediately go up the hill to avoid a tsunami disaster. This local wisdom made the tsunami victims in Simeule only 6 people, even though the total disaster victims during the earthquake in Aceh in 2004 reached hundreds of thousands (Gadeng et al., 2019). Other Indonesian local wisdom that can be used as a disaster mitigation effort, such as the local wisdom of the Bedouin tribe which prohibits cutting down trees in the "Leuweung Titipan" area and the Mentawai tribe with the "Sabulungan" tradition which is a teaching to maintain the balance of nature (Triastari et al., 2021).

The fourth model is by developing or implementing disaster education programs in schools. Ikeda et al. (2021) developed a disaster education management program in schools specifically for heavy rainfall disasters with the core development being objectives, materials, and program evaluation. The program aims to increase student preparedness in Nagoka City, Japan. Another program called "Reconstruction Mapping Program". Students are taught to map reconstruction that is adapted to the environment in which they live with the aim that students are involved in recovery efforts in their respective regions (Sakurai et al., 2020). Schools in Bantul, Yogyakarta, Indonesia also implement a disaster preparedness program in schools which is carried out with several activities such as conducting disaster preparedness training, making maps and disaster evacuation routes, integrating disaster with the curriculum, and working with external parties to increase the preparedness of the academic community. school (Khotimah et al., 2019).

The fifth model is by optimizing smartphone functions because currently smartphones are very close to students' daily lives. One way is to develop educational games related to disaster. These efforts as mentioned by was able to increase students' disaster knowledge. The use of mobile learning-based teaching materials using smartphones is also said to be able to increase student understanding regarding volcanic eruptions and the mitigation efforts that must be carried out (Wardaya et al., 2021). Smartphones can also be used to develop various

interactive learning media that can increase student motivation and disaster literacy (Mardani, 2021).

Disaster Education at the High School Level

Disaster education at the high school level can be carried out in various models as shown in Figure 4. The first is by organizing disaster training, as is done by schools in Klaten Regency, Central Java, Indonesia. Training is carried out in groups, where in each group there is a teacher who guides the discussion process about disaster vulnerability that occurs in the environment contextually. In addition to discussions, students are also taught self-rescue steps in the event of a disaster. Students immediately practice it by doing a simulation in the event of an earthquake. Training is also equipped with how to provide first aid to disaster victims and how to conduct mass evaluations (Suharto, 2020). The same dissemination and disaster preparedness training was also held by Nurkholifah & Sumunar (2021) in Yogyakarta, Indonesia which is prone to earthquakes.

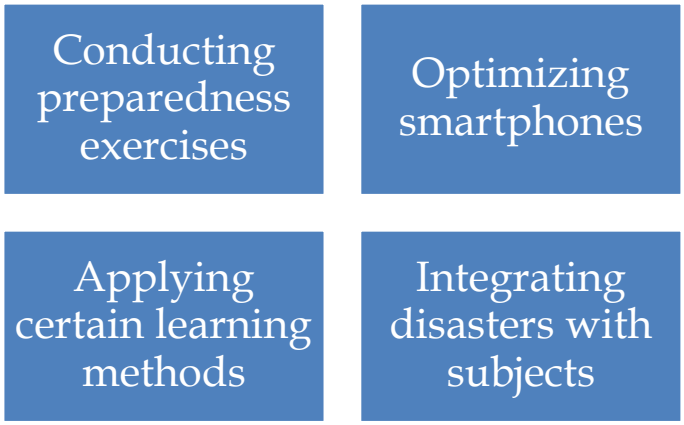

Figure 4. Disaster Education Model at the Middle School Level

The second model of delivering disaster education is by utilizing technological developments, especially smartphones. Even so, in its implementation, it is first investigated about the characteristics of the area and students and their level of awareness of disasters (Yamada et al., 2018). Smartphones can be used to store and operate applications and games related to disasters which are known to be effective in increasing student preparedness in dealing with disasters (Wahyuningtyas et al., 2021; Yanque et al., 2018). Ersani (2021) also developed a disaster education game called "Snake and Ladder" which has proven its effectiveness in increasing student preparedness for earthquake disasters.

The third model is by applying certain learning methods. The Kamishibai method, as has been done by Sundawa et al. (2020) stated that they were able to convey disaster material in an interesting and easy-to-understand way with the help of pictures. Another method that can be applied is Problem-Based Learning. This model invites students to study disaster material contextually by presenting problems that students can sense, so that disaster learning becomes easier to understand as mentioned by Azis (2021). The experiential learning method is also known to increase student preparedness in dealing with disasters. This model has several learning stages such as observation, reflection, conceptualization, and implementation which make disasters more real for students (Sumarmi et al., 2020). Mohadjer et al. (2021) also implements a paired teaching model accompanied by a video that interactively introduces students to earthquakes. Supriyadi et al. (2019) and Atmojo et al. (2020) also applies the SETS (Science Environment Technology and Society) learning model which is proven to increase students' disaster literacy.

The fourth model is through integration with subjects. Geography is a subject with great opportunities to be integrated with disaster education (Fuhrmann et al., 2008). The core of this subject in the form of natural events and their interactions with humans are very relevant to disasters which are disturbances in this process (Gong et al., 2021). Increasing geographic literacy can increase student knowledge (Kamil et al., 2020). Further research by Juhadi et al. (2021) states that disaster education in secondary schools can not only be carried out through learning geography, but also in all existing subjects, whether in the form of science, social, economics,

arts, to sports. Ramadhan et al. (2019) agree with this by stating that disaster education can be done through language learning. Disaster education can also be carried out through science learning (Park, 2020; Tyas et al., 2020). Science learning that can be used includes learning physics which is associated with earthquake disasters (Einde et al., 2016).

Disaster Education in Higher Education

Students at the tertiary level are independent learners. Lecturers will teach through an andragogical approach. Students in learning must be able to be independent and no longer depend on lecturers, including in obtaining disaster education. Even so, Baytiyeh (2014) states that disaster education starts early and must continue to be promoted to tertiary institutions, mainly related to the reconstruction of attitudes and values. Several models of disaster education in tertiary institutions are shown in Fig. The first model for delivering disaster education at this level is direct involvement in overcoming disasters. Kurniawan et al. (2021) states that involvement in disaster management will be able to increase preparedness in dealing with disasters. Students can be involved in several stages of disaster management, starting from the planning, mitigation, emergency response, adaptation, rehabilitation, and evaluation stages.

The second model is by providing direct experience. Direct experience of being involved in disaster activities. Direct experience related to disasters can be obtained by students visiting areas affected by natural disasters, so that they can witness the destruction and losses experienced by the community firsthand (Pfefferbaum et al., 2018). Students' direct experience in dealing with disasters is also known to be more significant for increasing disaster preparedness, rather than through theoretical learning.

The third model is to make it one of the compulsory courses that must be taken. Taiwan is one country that has practiced it. So that these courses are not just an obligation, efforts to provide disaster education are not just in the form of theory, but also provide hands-on experience and practice. A novelty offered by Shyr et al. (2022) is to integrate social participation as a part of the course. This statement is supported by (Sözcü & Türker, 2021) which states that disaster education must be included in the curriculum for all levels of education, including at the tertiary level. Deta et al. (2019) and Wulandari et al. (2023) also support that disaster education be given to undergraduate students because their research results prove that disaster literacy of undergraduate students is still low. Several methods are offered, namely by using e-learning (Saiboon, 2021), game-based learning (Kankanamge et al., 2021; Thangagiri & Naganathan, 2016), and by integrating with STEM-based learning (Shahidullah & Hossain, 2022).

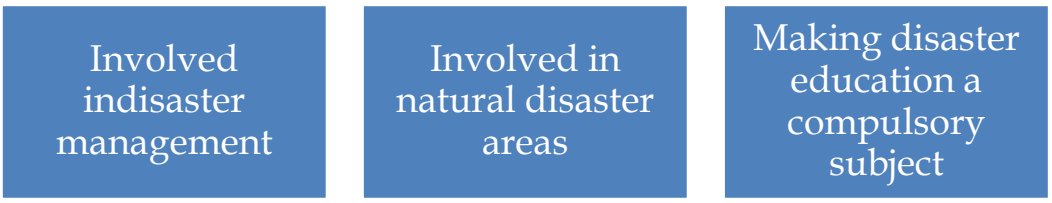

Figure 5. Disaster Education Model at the Higher Education Level

CONCLUSION

Based on the discussion that has been done, it can be concluded that disaster education must be delivered by formal education institutions. The implementation model at the early childhood level is carried out during the learning process through various fun activities, storytelling, and through websites. The implementation model at the elementary school level is through camps, training, integrated with learning and local wisdom, implementing programs in schools, and by optimizing smartphone functions. The implementation model at the high school level is disaster training, smartphone optimization, integration with subjects, and the application of relevant learning models. The implementation model in higher education is by being directly involved in the management and directly involved in natural disaster areas.

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