Trends and Innovative Approaches in Disaster Literacy Education for Elementary School Students

Niki Desvidisa Aryani[1*], Henita Rahmayanti[2], Cecep Kustandi[3]

[1,2,3]Doctoral Program in Elementary Education, State University of Jakarta, Indonesia.

Corresponding Author: niki.desvidisa@mhs.unj.ac.id

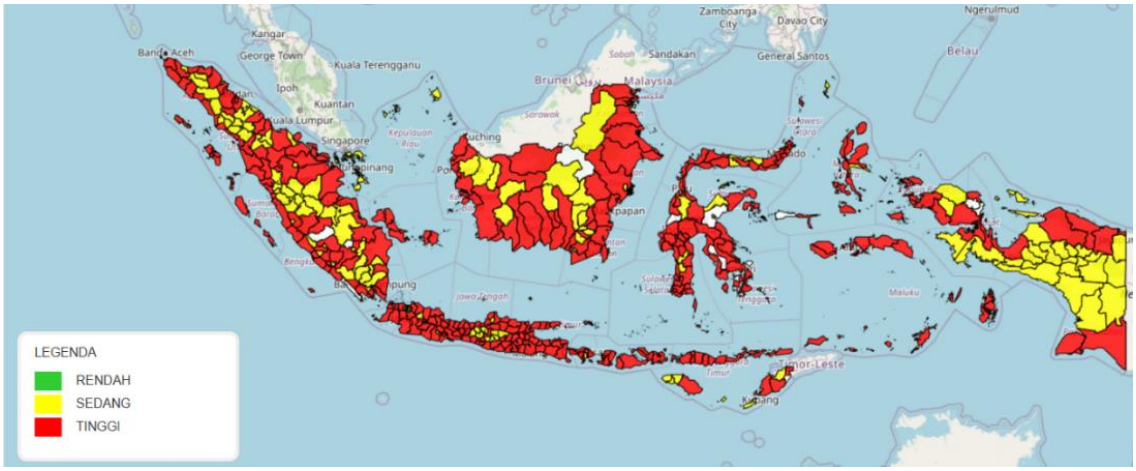
Abstract: Indonesia is one of the countries with a high level of vulnerability to natural disasters because it is geographically located in the Pacific Ring of Fire region and is at the confluence of the world's three main tectonic plates. This condition makes the Indonesian region very vulnerable to various types of disasters. One of the groups most vulnerable to the impact of disasters is primary school-aged children. Therefore, disaster mitigation education for elementary school students is a strategic step in forming a resilient generation and ready to face disaster risks from an early age. This research aims to examine various trends and innovative approaches applied in disaster literacy education at the elementary school level. This study uses a literature review method with data collection techniques in the form of analysis of scientific articles published in national and international journals in the range of 2020 to 2024.The results of the analysis found that the trends and innovative approaches in disaster literacy education in elementary school students are integrating with thematic curricula and increasing stakeholder engagement, the use of story-based media, the use of interactive technology, using STEM approaches and experiential learning, project-based learning, and local wisdom-based approaches. The analysis shows that the application of innovative approaches makes a significant contribution to the improvement of disaster preparedness knowledge, attitudes, and skills in primary school students. These findings provide important implications for the development of contextual, adaptive, and sustainable disaster education policies in the basic education system in Indonesia.

Keywords: disaster literacy, elementary school, educational innovation, disaster mitigation, interactive learning

INTRODUCTION

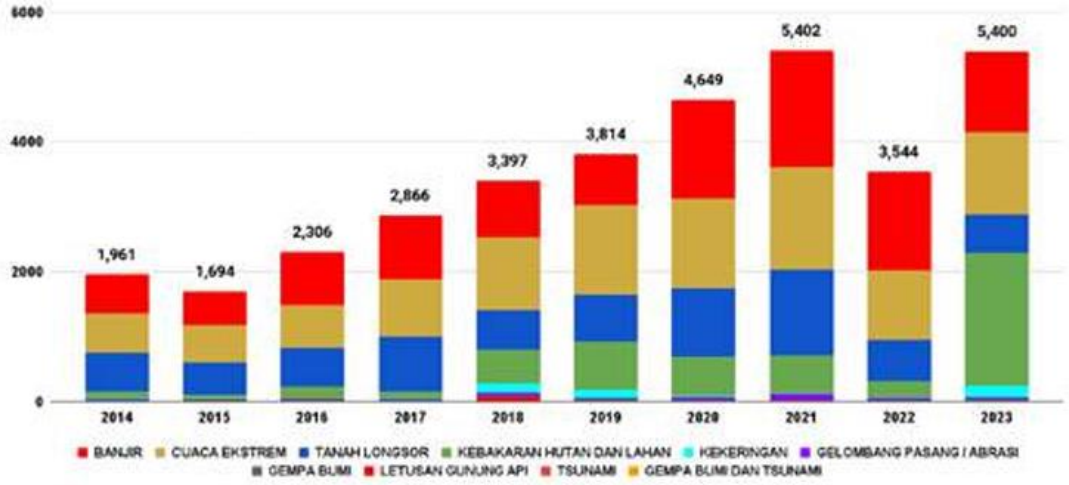
Indonesia is the second most disaster-prone country in the world (Atwii et al., 2022). The country is located in an area known as the Pacific Ring of Fire, an active geological zone where several of the world's major tectonic plates meet, including the Eurasian, Indo-Australian, and Pacific plate. As a result, Indonesia is highly vulnerable to various types of natural disasters, including earthquakes, tsunamis, volcanic eruptions, flash floods, landslides, tornadoes, and prolonged droughts(Adi et al., 2022, 2024; Supendi et al., 2023).

Figure 1. Map of Indonesia's Disaster Risk Index



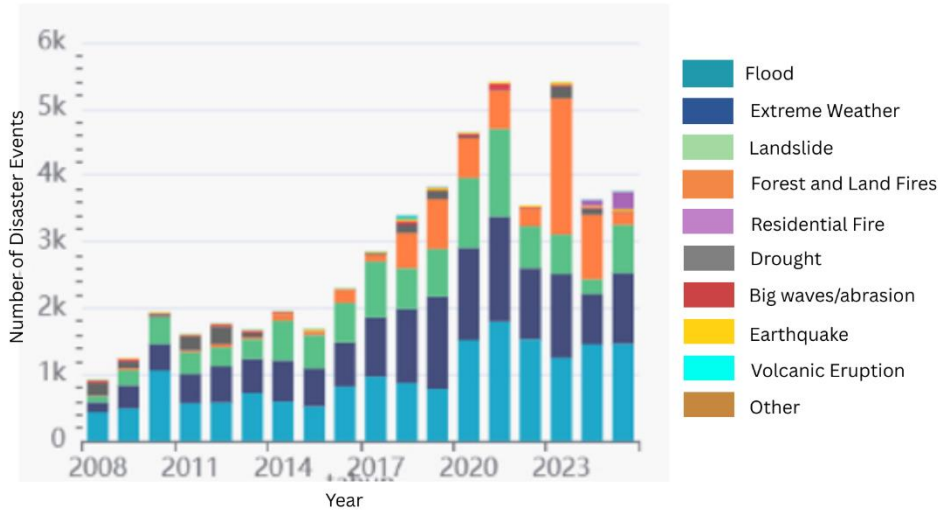
Based on the Disaster Risk Index Map, it shows that the distribution of disasters in Indonesia is almost spread throughout the region, such as earthquakes that occurred in several regions in Indonesia, both accompanied by tsunamis and not, indicating that natural disasters are a real threat faced by the Indonesian people (Adi et al., 2022).

Figure 2. Trends in Disaster Occurrences in Indonesia



In the last ten years, Indonesia has shown a tendency towards increasing frequency of natural disasters, both geological such as earthquakes and volcanic eruptions, and hydrometeorological such as floods and landslides. This increasing trend is an indication that disaster risks are becoming more real and complex along with environmental dynamics and climate change. However, data shows that there was an exception in 2022, where the number of disasters decreased relatively compared to previous years (Adi et al., 2024).

Figure 3. Numbers of Disaster Incidents Based on Disaster Category



Based on this data, it shows that in the last more than a decade, Indonesia has shown a tendency to increase the number of disaster events every year. Data from the National Disaster Management Agency (BNPB) illustrates that from 2008 to 2021, the number of disaster events continued to increase significantly. The most drastic increase was seen in 2020 and 2021, where the number of disasters reached more than 5,000 incidents per year. This indicates that the frequency of disasters in Indonesia is getting higher, both in terms of number and intensity. However, in 2022 there was a slight decrease in the number of incidents compared to the previous two years, making it an anomaly in the trend of the last ten years. However, this decline is temporary, because in 2023 there will be another increase in the number of disaster events, close to the figures in previous years. The 2024 data, although not yet complete, already shows a fairly high figure until the middle of the year, indicating that the upward trend is still continuing. The most prevalent types of disasters during this period are floods and extreme weather. Both are hydrometeorological disasters that are closely related to climatic factors, environmental damage, and land use change. In addition, other disasters such as landslides, forest fires, and volcanic eruptions have also been recorded consistently albeit in smaller numbers.

Data shows that school-age children are a vulnerable group in disaster events. For example, the 2005 Pakistan earthquake killed more than 16,000 children due to the collapse of school buildings, and the 2008 Sichuan earthquake recorded 5,355 deaths out of a total of 87,000 fatalities (Parhizkar et al., 2023). In Indonesia, the 2004 Aceh

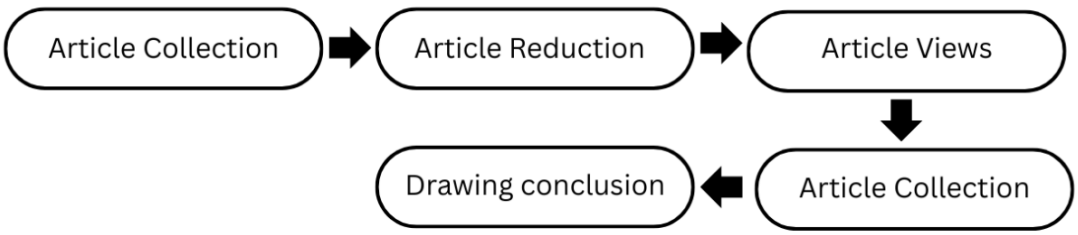
earthquake caused 385 school children to die, while the 2022 Cianjur earthquake resulted in 23% of the victims out of 334 people being children aged 6–16 years (Adi et al., 2024). Globally, 60% of disaster victims are children (UNDRR, 2015), and in Indonesia, 107 million school-age children are exposed to disaster risk (BNPB, 2020). The high number of victims in this group is due to the time of the incident often coinciding with school hours, weak building structures, and the lack of knowledge and preparedness of children in saving themselves (Amalia et al., 2022; Najmanová & Ronchi, 2023). A survey in Japan after the 1995 Hanshin-Awaji earthquake showed that survivors who were able to save themselves had the highest survival rate (34.9%). This emphasizes the importance of disaster literacy from an early age (BNPB, 2023; Dewi et al., 2024).

Seeing this condition, there is a need for systematic efforts to increase disaster mitigation capacity, especially through education in elementary schools. This research aims to explore the latest innovations and approaches in disaster literacy education that are relevant and interesting to elementary school students.

METHOD

This study uses a literature study method. A literature review is a search and research of literature by reading various books, journals, and other publications related to the research topic to produce an article related to a particular topic (Marzali, 2016). The data collection technique used is articles that have been published in national and international journals in 2020-2024. The steps in this study can be seen in the image below:

Figure 4. Stages of Literature Review (Marzali , 2016)



RESULT AND DICSUSSION

RESULT

Table 1. Articles based on the variables studied

Writer	Research title	Findings
(Septikasari et al., 2022)	Disaster Risk Reduction and Prevention Education (DRR) as a Resilience Strategy for Elementary Schools in Disaster Management	PRB education is effective if integrated into learning (curriculum, local content, extracurricular). Multi-party involvement (parents, communit, agency) is important for successful implementation. Schools cannot work alone collaboration is the key to building a sustainable disaster awareness culture.
(Wulandari et al., 2023)	Literature Review: Analysis Of Disaster Mitigation Integration in Learning	This research emphasizes that disaster mitigation education is very important to be implemented in the educational curriculum from an early age. Disaster mitigation integration efforts need to be carried out in a structured manner, through a varied approach that is relevant to local conditions. Thus, education can play a key role in shaping a generation that is ready and resilient in dealing with disasters.
(Fara et al., 2025)	Integrated Flood Disaster Mitigation at science and social Sciences in Elementary School	This study found that the integration of flood disaster mitigation materials into social studies learning is effective in improving students' understanding and preparedness. These findings confirm the importance of contextual and collaborative learning in disaster education in primary schools.
(Qurrotaini & Nuryanto, 2020)	Implementation of Natural Disaster Mitigation Education Earthquake in Elementary Social Studies Learning	This study found that natural disaster mitigation education has been implemented well. Schools also routinely carry out evacuation simulations every six months, as a form of preparedness exercise. In addition, the school has collaborated with BNPB and regional Basarnas to support mitigation activities.
(Salwa Salsabila & Rafa Dinda, 2021)	Disaster Mitigation Learning in Elementary Schools with Demonstration Methods	The demonstration method in disaster mitigation learning in elementary school is able to increase students' understanding of the concept of disaster as a whole.
(Anggraeni, 2019)	Implementation of the Basic Education Curriculum of Environment and Disaster Mitigation in Elementary Schools	The implementation of the Environmental Education (PLH) curriculum integrated with disaster mitigation materials in elementary schools is an effective form of non-structural mitigation to improve the preparedness of school residents for disasters.
(Arni et al., 2025)	Strengthening Disaster Preparedness Through Mitigation Education at Elementary School in Sungai Pedada, Tulung Selapan	Training provided in an applicative and context-based manner makes teachers feel helped, more confident, and motivated to develop innovative and contextual teaching materials. In addition, this activity is also the first step in forming a disaster awareness culture in the school environment.
(Omari et al., 2021)	Influence Of Principals' Involvement in Staff Awareness Safety Strategies on Disaster Management in Public Secondary Schools in Nyeri County, Kenya	This study concluded that staff awareness of safety strategies facilitated by school principals has a significant effect on the effectiveness of disaster management in schools.

Writer	Research title	Findings
(Damayanti et al., 2023)	Disaster Mitigation Training with the Kamishibai Method	The Kamishibai method (storytelling with pictures) has proven to be effective in earthquake and tsunami disaster mitigation training in elementary schools.
(Seni, 2022)	Fairy Tales as a Media to Build	Fairy tale media is effective in building disaster
(Arif et al., 2021)	Disaster Preparedness for Elementary School-Age Children	preparedness in elementary school students
(Yana et al., 2020)	Implementation of Disaster Preparedness Education as an Effort to Increase Elementary School Students' Knowledge of Disaster Mitigation in Sitiarjo Village, South Malang Regency	Disaster Preparedness Education is effective in increasing students' knowledge about disaster mitigation
(Kartika et al., 2023)	Development of Picture Storybook Media to Improve Children's Understanding of Disaster Mitigation	The researcher developed a medium of illustrated storybooks of earthquake and tsunami disasters and was effective in improving children's understanding of disaster mitigation.
(Novitasari & Qurrotaini, n.d.)	Development of Augmented *Reality-Based Disaster Mitigation Storybook Learning Media*	Researchers developed Augmented Reality-based disaster mitigation storybooks and are effective in increasing students' knowledge of disaster mitigation.
(Parastika Aulia et al., 2022)	Development of Comic Media Based on Disaster Mitigation in Grade 3 Elementary School Students	The researcher produced comic media based on disaster mitigation for third grade elementary school students. The results of this study show that the developed media is suitable for use in the learning process.
(Zuhdi et al., 2023)	Development of Comic Learning Media on Disaster Mitigation Materials for Class 5 Towards Disaster Preparedness Schools	Based on the results of data analysis, it was found that the disaster media that was developed is suitable for disaster preparedness school learning.
(Aco Karumpa & Muhammad Dahlan, 2022)	The Effectiveness of the Use of *Pop Up Book* and *Big Book* Media on Students' Ability to Understand the Content of Reading	The ability to understand the content of reading of students taught with *Pop Up Book* and *Big Book* media at Bontoramba State Elementary School has improved based on *the pretest* and *postest results* given. However, it was found that there was a significant difference in the use of the two media. The achievement of results or the ability to understand the reading content of class V A students who are taught with *Pop Up Book* media is very good compared to class V B which is taught using *Big Book media*.
(Anik Kurnia Ningsih et al., 2024)	*Noisy Environmentally Friendly Pop-up* Book with a Bilingual Concept Equipped with Interactive Games as an Effort to Optimize Flood Disaster Safe Education Units	The conclusion of this study is that the resulting media book is effective in optimizing the implementation of SPAB integratively, as well as effective in increasing students' understanding and concern for disaster mitigation and threats.
(Dewi et al., 2023)	Development of Pop Up Book Media for Flood Disaster Mitigation on the Logical Thinking Ability of Children Aged 5-6 Years	The researcher developed a pop-up book "Let's Prevent Flooding" for children aged 5-6 and this media is effective in introducing disaster mitigation to students. .
(Septyandy et al., 2025)	Disaster Pop-Up Book Media for Education to Increase School Disaster Capacity in Samarinda City	This activity contributes to the introduction of potential disasters that can occur in Samarinda City as an effort to reduce disaster risk in Samarinda City, especially in primary and secondary education units.

Writer	Research title	Findings
(Alviawati et al., 2021)	Increasing Disaster Mitigation Knowledge in School-Age Children Through Media of Educational Game "Utas-Gana" in New Moving Village	The results of the study show that using this media can improve disaster mitigation skills in school-age children.
(Putri & Suparti, 2020)	The Effect of Game Puzzle Education on The Knowledge of Volcanic eruption Disaster Mitigation in Elementary School	Educational disaster puzzle game increases knowledge of volcano eruption mitigation in elementary school.
(Nurdin et al., 2025)	Development of Web-Based Digital Teaching Materials on Natural Disaster Mitigation Materials	The researcher developed a website-based disaster mitigation teaching material and based on the results of the assessment of the media is suitable for use for the learning process.
(Rahman et al., 2024)	Disaster Mitigation Through Boardgames for School Children Basics in the Jakarta Serial Carpentry RPTRA South	It is hoped that learning media in the form of board games donated to RPTRA Petukangan Berseri can continue to be used as a means of learning for children in the RPTRA Petukangan Berseri.
(Rizky & Permatasari, 2020)	Mountain Eruption Disaster Mitigation Education Using Pasga Educational Game (Volcano Alert Force)	Based on the results of the research, the educational game developed can improve the learning outcomes of male students, but it is different from female students who experience a decrease in learning outcomes.
(Maharani, 2021)	Socialization and Earthquake Mitigation Using Virtual Reality-Based Media at Adzkiyah Alkhair Orphanage, West Denpasar District, Bali Province	Based on the results of research, Virtual Reality media can increase students' knowledge.
(Prayogi & Hendarto, 2024)	Educational Teaching Aids Experiment About Earthquakes and Their Mitigation for Elementary School Children with Augmented Reality Features	Based on the results of the data analysis, it shows that Augmented Reality-based teaching aids are suitable for the disaster mitigation learning process.
(Arwin et al., 2024)	STEM-based digital disaster learning model for disaster adaptation ability of elementary school students	STEM-based digital disaster learning model increases elementary school students' disaster adaptation abilities. The implications of this research can be used as a reference in developing elementary school students' disaster adaptation abilities.
(Puyanti et al., 2022)	Integrated Learning Design for Flood Disaster Mitigation through *Science, Technology, Engineering, Mathematic and Society Approaches*	The use of the STEMS approach and the PjBL learning model can improve students' cognitive, affective and psychosocial abilities, to provide an early preparedness attitude for disasters.
(Zulfiya et al., 2023)	Development of STEM (*Science, Technology, Engineering, and Mathematic) based digital teaching materials* on natural disaster mitigation sub-materials in Indonesia	Based on the results of the study, it can be concluded that STEM-based digital teaching materials with a high level of feasibility can be used for disaster mitigation learning.
(Rasidi et al., 2024)	Facilitation of the Mitigation-Based Pancasila Student Profile Strengthening Project (P5) to Realize Independent Learning at Elementary Schools	The Pancasila Profile Strengthening Project can improve mitigation and understanding of partners related to disaster mitigation.
(Saputra & Saputra, 2024)	Increasing Natural Disaster Mitigation Knowledge for	The results of the activity showed an increase in mitigation knowledge by 36% and positive responses

Writer	Research title	Findings
	Elementary School Students Through Education and Simulation in Earthquake-prone areas	from students and teachers. This activity is an important first step in forming a disaster response culture in the elementary school environment.
(Da Silva & Helnywati, 2021)	A Cross-Disciplinary Project-Based Learning to Raise Indonesian Students' Awareness of Natural Disasters	The findings indicate that the students have initial knowledge about how to survive from the disasters, but their literacy on disaster mitigation is still low. It is recommended that literacy on natural disasters should be part of the curriculum and implemented consistently.
(Londa & Kamaruddin, 2023)	The Implementation of Project Based Learning to Enhance Students' Understanding of Environmental Conservation and Disaster Mitigation	These results indicate that project-based learning can improve students' understanding of learning, particularly that related to environmental learning.
(Fahrozy, F. P. N. et al., 2022)	Analysis of Local Wisdom Elements in Shaping Students' Character in Elementary Schools	Local wisdom plays an active role in providing and fostering character education in aspects of life in children from early to old age who are always faced with the provision of local cultural teachings that lead to the formation of good character.
(Fatmawati et al., 2021)	Development of Worksheet Based on Local Wisdom on Natural Disaster Materials for Grade I Elementary School Students	Worksheet based on local wisdom natural disaster material for first grade elementary school students is suitable for use as an alternative or additional teaching material used during learning.
(Mustofa, 2020)	Disaster Education Based on Local Wisdom in Strengthening the Character of Disaster Preparedness	Based on the results of data analysis, it can be concluded that the implementation of disaster education based on local wisdom can improve the character of student preparedness. So that with the stronger character of student preparedness, it can reduce the risk in the event of a disaster.
(Rahmat et al., 2024)	Disaster Mitigation Learning Based on Local Wisdom: An Innovation in Building School Resilience	Locally-based disaster mitigation learning can increase school resilience.

DICSUSSION

1. History of disaster education in Indonesia

Disaster education has been implemented in Indonesia for a long time, but significant progress in its development only began after the 2004 Indian Ocean Tsunami. The milestones of disaster-safe schools in Indonesia can be seen in Table 2.

Table 2. History of Disaster Education in Indonesia

Year	Rules	Rationale
2019	SPAB Implementation	Permendikbud 33/2019
2017	The formation of a national formation for Comprehensive School Safety	Ministry of Education and Culture 110/P/2017
2016	Disability law	August 2016 Law
2014	Safety school and madrasah secretariat	Decree of the Secretary General of the Ministry of Education and Culture
2013	The Implementation of special education, including education in emergencies	Permendikbud 72/2013
2012	The implementation of guidelines for safe school and madrasah	BNPB Perka April 2021
2010	Incorporating Disaster Risk Reduction (DRR) in Education in Indonesia	From 70/MPN/s/2010
2008	Establishment of the National Disaster Management Agency	Presidential Decree August 2008
2007	Standard rules for building and facilities in elementary and secondary school	Permendiknas 24/2007
2007	Disasater management law	Law 24/2007

Source: Amri. 2022

Table 2 explains that in the last 16 years, there have been 10 official regulations related to disaster education in Indonesia. SPAB is the latest program stipulated in Permendikbud No. 33 of 2019.

2. Trends in Disaster Mitigation Education in Elementary Schools

Based on an analysis of a number of literature studies published in the last five years, it was found that disaster mitigation education in elementary schools has undergone significant development, both in terms of content, learning strategies, and the integration of education policies.

a. Integration of thematic curriculum in Disaster Mitigation Education

One of the strategic approaches in disaster mitigation education is to integrate disaster materials into the thematic curriculum, especially in subjects such as IPAS and PPKn. The material is not taught separately, but is inserted in the context of relevant lessons, making it more contextual and easy for elementary school students to understand (Septikasari et al., 2022; Wulandari et al., 2023). In the science subject, students learn scientific concepts related to disasters, such as the causes of earthquakes, floods, and volcanic eruptions and their impact on the environment (Fara et al., 2025; Qurrotaini & Nuryanto, 2020; Salwa Salsabila & Rafa Dinda, 2021). Meanwhile, in PPKn, disaster education is emphasized on the value of mutual cooperation, social concern, and the role

of citizens in dealing with disasters (Anggraeni, 2019; Pancasila et al., 2024). The Merdeka curriculum reinforces this approach through the flexibility of project-based and contextual learning, providing space for schools to develop disaster literacy according to the needs and characteristics of their respective regions. Thus, the integration of the thematic curriculum is an effective and sustainable step in shaping student preparedness from an early age

b. Increased stakeholder engagement

One of the important trends in disaster mitigation education in elementary schools is the implementation of a school-based disaster education approach that places schools as the center for strengthening disaster preparedness. This approach involves the entire school ecosystem and is supported by cross-sectoral collaboration, such as BPBD, education offices, and local communities (Arni et al., 2025). Activities such as the integration of disaster materials into the curriculum, evacuation simulations, the formation of school disaster preparedness units, and teacher and student training are carried out systematically (Diansanita et al., 2024; Omari et al., 2021). Stakeholder engagement enriches the education process through counseling, field training, and technical support relevant to local conditions. This approach reflects a shift from a reactive to a preventive pattern, where the instillation of preparedness value is done before a disaster occurs, rather than after. In addition to increasing students' disaster literacy, it also strengthens the involvement of parents and the community, and forms a sustainable culture of preparedness in the school environment (Omari et al., 2021).

This indicates a paradigm shift from a passive (theory-based) approach to an active and participatory approach that emphasizes contextual and collaborative learning experiences.

3. Inovative Approaches in Disaster Mitigation Education for Elementary School Students

The studies analyzed also reveal a range of innovative approaches that have been developed and tested in the context of disaster mitigation learning for primary school students. Some of these include:

a. Story-based media (*storytelling*, comics, *pop-up books*)

Innovative approaches in disaster mitigation education in elementary schools are increasingly utilizing story-based media to convey disaster information in an interesting

and easy-to-understand way for children. Media such as *storytelling*, *Educational Comics*, *pop-up book* It has proven to be effective in building disaster literacy because it presents content in the form of narratives that touch on students' cognitive, affective, and psychomotor aspects. Media *storytelling* Help students understand disaster situations through easy-to-identify storylines and characters. Narratives involving children's characters with catastrophic conflicts encourage students to empathize and understand the importance of preparedness (Damayanti et al., 2023; Seni, 2022; Yana et al., 2020). While *Educational Comics* convey a message through a combination of visual and light text, which is very much in line with the characteristics of the Alpha generation who tend to be visual and quickly get bored of long texts (Kartika et al., 2023; Novitasari & Qurrotaini, n.d.; Parastika Aulia et al., 2022; Zuhdi et al., 2023). *Pop-up book* present three-dimensional illustrations that stimulate imagination while strengthening students' visual memory of the evacuation stages or mitigation tools (Aco Karumpa & Muhammad Dahlan, 2022; Anik Kurnia Ningsih et al., 2024; Dewi et al., 2023; Septyandy et al., 2025). The use of story-based media in disaster mitigation education is not only pedagogically interesting, but also facilitates the internalization of values such as empathy, responsibility, and courage in dealing with disasters. Research has also shown that this approach is able to improve information retention and student preparedness in emergency situation.

b. Interactive Technology (Educational Games, Websites, AR/VR)

The use of interactive technology in disaster mitigation education is one of the innovative approaches that is growing rapidly along with the increasing access and digital literacy among elementary school students. Technologies such as *Educational Games*, *Interactive Website Platform*and *augmented reality (AR)* and *virtual reality (VR)* has been proven to be able to increase the effectiveness of disaster learning by providing an immersive, engaging, and meaningful learning experience. Disaster-based educational games facilitate students to learn through simulation and problem-solving in the context of games. This game not only conveys information, but also trains decision-making skills in emergencies (Alviawati et al., 2021; Kaplia et al., 2024; Putri & Suparti, 2020). Some of the games developed invite children to recognize the signs of disaster, evacuate, or arrange emergency equipment (Rahman et al., 2024; Rizky & Permatasari, 2020). This

approach is very much in line with the characteristics of the Alpha generation who like visualization and interactivity as in learning.

Interactive websites are also an important medium in conveying disaster information systematically. Through animations, educational videos, interactive quizzes, and digital simulations, the website is able to integrate disaster materials with various student learning styles (Nurdin et al., 2025). In addition, the website allows for flexible learning that can be accessed anytime and anywhere, and can engage teachers, students, and parents at the same time.

Meanwhile, AR and VR technologies allow students to explore disaster situations in a safe virtual environment. For example, students can experience the atmosphere of an earthquake, flood, or volcanic eruption through a VR headset or AR app on their device (Hakim et al., 2025; Maharani, 2021). In this way, students not only understand the concept of disaster theoretically, but also experience firsthand how to respond correctly in such situations (Disaster, 2025; Prayogi & Hendarto, 2024). The application of interactive technology in disaster mitigation education is able to increase students' learning motivation, information retention, and critical and reflective thinking skills. This technology also opens up learning opportunities that are personalized and adaptive to the needs of each student.

c. STEM and Experiential Learning Approach

STEM Approach *(Science, Technology, Engineering, and Mathematics)* and *experiential learning* (hands-on experiential learning) is an important innovation in disaster mitigation education in elementary schools. The main goal is to equip students with 21st-century skills, such as critical thinking, problem-solving, and collaboration through the real-world context of disasters. In practice, the STEM approach encourages students to understand disaster phenomena through science, utilize technologies such as early warning applications, design simple engineering solutions (e.g. earthquake-resistant building models of ice cream sticks), and use mathematics to calculate risk or evacuation speed (Arwin et al., 2024; Puyanti et al., 2022; Zulfiya et al., 2023). Meanwhile, the *experiential learning* emphasizing hands-on activities such as disaster simulations, collaborative projects, visits to BPBD, and evacuation exercises. These activities form meaningful experiences that help students not only understand concepts, but also apply skills in real-life situations (Rasidi et al., 2024; Saputra & Saputra, 2024).

d. Project-Based Learning

Project-based learning *(Project-Based Learning)* is a learning approach that actively engages students in designing and completing real projects related to a specific topic. In elementary school students, this approach is particularly effective for fostering critical, collaborative, and responsible thinking skills through meaningful and contextual activities. In the context of disaster mitigation, students can be involved in projects such as creating a school disaster-prone map, designing a family evacuation plan, or drafting a disaster awareness campaign. Through this activity, students not only understand the concept of disaster in theory, but are also able to apply it in daily life. Project activities also encourage students to work together, discuss, observe the surrounding environment, and produce real solutions. Teachers play the role of facilitators who guide the learning process so that it remains directed and in accordance with the goals. With this approach, learning becomes more active, creative, and relevant to students' real worlds, while strengthening their disaster preparedness from an early age (Da Silva & Helnywati, 2021; Londa & Kamaruddin, 2023).

e. Local Wisdom-Based Approach

A local wisdom-based approach is a learning strategy that integrates traditional values, practices, and knowledge of the community in the student learning process. In the context of disaster mitigation, local wisdom often contains valuable information that is passed down from generation to generation, such as natural signs and how to survive when disasters occur (Fahrozy, F. P. N. et al., 2022; Fatmawati et al., 2021). For elementary school students, this approach is effective because the material is delivered through folklore, cultural symbols, regional songs, or traditional games that are familiar and easy to understand (Mustofa, 2020; Rahmat et al., 2024). Involving local wisdom also strengthens students' relationships with their culture and environment, while encouraging family and community participation in disaster education. Thus, students not only understand disaster risk scientifically, but also form resilient, caring, and strong cultural identities. These approaches are considered to be able to increase active student involvement, strengthen understanding of concepts, and form disaster response attitudes and habits from an early age.

3. Challenges in Disaster Mitigation Education in Elementary School Students

Although disaster mitigation education has a high urgency, its implementation at the elementary school level in Indonesia still faces a number of significant challenges, both in terms of policies, human resources, and learning environment support.

a. Limitations of Formal Curriculum

Disaster material has not been fully integrated into the national curriculum as an independent subject. Generally, disaster literacy is only inserted in subjects such as sains and social or local content on a limited basis, so not all students get an adequate understanding of disaster preparedness (Adi et al., 2022, 2024).

b. Lack of Teacher Competence in Disaster Education

Many elementary school teachers do not have any special training in disaster mitigation teaching. Low disaster literacy among educators results in delivery methods that are less applicable and not contextual with the type of risk in their respective regions (Adi et al., 2022, 2024).

c. Lack of Learning Resources and Interesting Educational Media

Thematic and interactive learning media such as visual modules, props, educational games, and digital technology are still limited. In fact, elementary school students need a concrete, visual, and fun learning approach to make it easier to understand disaster material (Ersoy & Koçak, 2016; Rachman et al., 2024; Wulandari et al., 2023).

d. Infrastructure Constraints and Simulation Facilities

Not all schools have adequate facilities for the implementation of disaster evacuation simulations. This is an obstacle in training students' practical skills, such as how to take shelter during an earthquake or evacuation routes during floods (UNICEF, 2022).

e. Low Parental and Community Participation

Disaster education efforts have not fully involved the role of parents and the community around the school. In fact, their involvement is important in creating a sustainable preparedness ecosystem, both at home and in the surrounding environment (Pahleviannur, 2019; Shah et al., 2024)

f. Regional Inequality and Access to Education

Schools in remote or 3T areas (disadvantaged, frontier, and outermost) often experience gaps in access to training programs, disaster information, and support from relevant institutions. This widens the gap in disaster literacy between regions (Pahleviannur, 2019).

IMPLICATION

Innovative approaches that have been identified in various studies have been proven to contribute positively to improving students' disaster literacy, both in cognitive (knowledge), affective (attitude), and psychomotor (skill) aspects. Students who engage in story-based, project-based, and simulation-based learning activities show a better understanding of the types of disasters, preventive measures, and self-rescue measures. This reinforces the importance of transforming learning methods from conventional to a more contextual and experience-based approach.

CONCLUSION

This study concludes that innovative approaches in disaster literacy education, such as the integration of thematic curriculum, story-based media, interactive technology, project-based learning, STEM approaches, experiential learning, and local wisdom, are able to improve the knowledge, attitudes, and disaster preparedness skills of elementary school students. Theoretically, this study enriches the literature on disaster education strategies that are contextual and based on the needs of students. Pedagogically, these results support the importance of holistic, participatory, and real-life experience-based learning to shape children's preparedness from an early age.

The implications of these findings lead to the need for the formal integration of disaster education into the primary education system, as well as the active involvement of school and community stakeholders. However, the limitations of this study lie in the scope of the literature sources which only cover publications in the last five years and have not explored in depth the effectiveness of each approach in a specific local context. Therefore, further research is recommended to conduct experiment-based field studies to test the impact of the implementation of these approaches directly in various disaster-prone areas in Indonesia.

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