# Reconceptualizing Disaster Resilience in Early Childhood Education: A Systematic Review of ICT-Mediated Curricula Trends (2013-2023)

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**ABSTRACT**

Disasters can have a significant impact on children's well-being, making it important to effectively educate them on risk mitigation and potential hazards. This research aims to reveal the scope of research on the topic of ICT Media-Based Disaster Curriculum from 2013 to 2023. This research systematically analyses the research content on Disaster Curriculum through ICT media. A systematic review was conducted using the Systematic Review and Meta-Analysis (PRISMA) procedure. The results of article searches conducted through Google Scholar Search using the Publish or Perish 8 application with various related keywords found 810 papers in the period 2013 to 2023. From the screening and eligibility results, 11 articles were included. From the analysis results, 9 articles have different country distributions in each article. Meanwhile, according to the year of publication, research related to the ICT Media-Based disaster curriculum has decreased every year. The results showed that although the publication of ICT Media-Based Resilience Curriculum articles distributed in journals is very diverse, the existence of research on the topic of ICT Media-Based Resilience Curriculum from 2013 to 2023 has decreased so further research is needed to improve the topic again.

***Keywords:*** *Disaster Curriculum, Early Childhood Education, ICT Media*.

## 1. INTRODUCTION

In the contemporary landscape of early childhood education (ECE), the development of disaster-related curricula increasingly relies on advanced data representation, such as density visualization, to identify core thematic priorities. Density visualization serves as a foundational instrument for mapping educational content, enabling policymakers and curriculum designers to move beyond superficial instructional models toward data-driven decision-making (Haleem et al., 2022). By identifying areas of high conceptual density, educators can pinpoint critical themes that require intensified focus, ensuring that curriculum development addresses the most applicable risks for young learners (Zosh & al., 2022). This visualization not only clarifies the hierarchy of priorities but also reveals the intricate interconnections—and gaps—between disparate elements within disaster pedagogy. Consequently, it allows for the design of a coherent, intertwined structure where complex disaster concepts are synthesized into meaningful learning experiences (Borg & Samuelsson, 2022).

Furthermore, the shift toward visualization-supported frameworks optimizes student learning by transforming dense, complex data into interpretable trends and patterns. Recent scholarship emphasizes that meaningful disaster literacy in early

childhood is achieved when learning experiences are focused and contextually relevant (Trott, 2022). Networking and conceptual density mapping facilitate this by making disaster-related knowledge accessible, thereby helping children develop deeper cognitive understanding and practical skills. This approach also enhances transparency and communication among stakeholders, including educators, caregivers, and institutional partners, providing a shared visual language to discuss curriculum focus and collaborative goals (Elliott et al., 2024).

Moreover, a visualization-centric approach fosters an adaptive pedagogical stance. Given the rapid evolution of technology and the shifting nature of global environmental risks, curriculum inventors must remain responsive to the latest requirements (Biesta, 2022). Density visualization aids this agility, allowing for continuous monitoring and evaluation of a curriculum's effectiveness and its measurable impact on students. By tracking the density of specific instructional elements, designers can estimate the extent to which a program achieves its desired literacy objectives, ensuring that the curriculum remains a robust tool for developing children's capacities to respond effectively before, during, and after disaster events (Hattie & Donoghue, 2023).

This systematic review is grounded in an ontological framework that views disaster resilience not merely as a technical skill or a memorization of emergency protocols, but as a dynamic social reality constructed through interactive experiences (O'Grady, 2022)). In this study, ICT media is positioned as a transformative mediator that bridges the gap between abstract disaster concepts and a child's concrete understanding (Haleem et al., 2022). Unlike conventional methods that rely on passive rote-learning, ICT-mediated curricula allow children to simulate, visualize, and interact with complex environmental phenomena in a safe yet immersive digital environment (Zosh & al., 2022). This ontological stance asserts that a child's understanding of disaster risks is significantly shaped by the digital tools used to represent those risks, thereby making ICT an essential pedagogical 'lens' through which the reality of disaster mitigation is internalized and understood (Parker & Freathy, 2021; Schweitzer et al., 2022).

## 2. RESEARCH METHODS

This study employed a Systematic Literature Review (SLR) grounded in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement to ensure a rigorous, replicable, and transparent selection process. The SLR approach was chosen to synthesize fragmented evidence regarding digital pedagogy in disaster education, allowing for a comprehensive mapping of the current state-of-the-art (Brod, 2021). The methodology was systematically executed through four distinct phases: identification, screening, eligibility, and inclusion.

### 2.1 Search Strategy and Identification

The initial identification phase involved an extensive electronic database search via Google Scholar, facilitated by the Publish or Perish 8 application. This tool was utilized to maximize the harvest of metadata from diverse academic repositories, ensuring a broad multidisciplinary reach (Sahin, 2021). The search strategy employed specific Boolean operators and keywords: *"disaster curriculum"* AND *"early childhood education"* AND *"ICT media"*. To capture the most recent technological trajectories and "digital-native" pedagogical shifts, the search was limited to the decade between 2013 and 2023 (Mercer, 2019). This timeframe is critical as it encompasses the rapid digital transformation in ECE accelerated by global environmental crises. The initial search yielded a total of 810 records.

### 2.2 Screening and Eligibility Criteria

To refine the results, a two-stage screening process was implemented, adhering to high standards of methodological integrity (Hattie & Donoghue, 2023). In the first stage, duplicates and non-article records—including citations, book reviews, and papers with incomplete metadata were removed to maintain data purity, leaving 425 articles. In the second stage, titles and abstracts were rigorously screened based on predefined Inclusion and Exclusion Criteria to ensure the ontological relevance of the literature (O'Grady, 2022).

To ensure the objectivity of the selection process, specific eligibility criteria were established based on several parameters including time frame, document type, target population, and thematic relevance, as summarized in Table 1.

**Table 1.** Inclusion and Exclusion Criteria

| No | Criterion | Inclusion Criteria (IC) | Exclusion Criteria (EC) |
|---|---|---|---|
| 1 | Time Period | Articles published between 2013 and 2023. | Articles published before 2013 or after 2023. |
| 2 | Document Type | Original research articles from peer-reviewed journals. | Book chapters, conference abstracts, editor notes, or citations only. |
| 3 | Target Population | Early Childhood Education (ECE) / Children aged 0–8 years. | Higher education, secondary education, or adult disaster management. |
| 4 | Core Topic | Integration of ICT-based media in disaster education/curriculum. | General disaster studies without ICT or curriculum focus. |
| 5 | Language | Full-text articles written in English or Indonesian. | Articles in languages other than English or Indonesian. |
| 6 | Accessibility | Open access or available full-text through institutional repositories. | Abstract only or restricted access (no full-text available). |

### 2.3 Data Extraction and Inclusion

After applying the IC/EC, 38 full-text articles were assessed for eligibility. Articles were excluded if they only mentioned ICT peripherally without integrating it into the curriculum framework. This rigorous filtration resulted in **11 final articles** that strictly met all quality and thematic requirements.

### 2.4 Data Analysis (Thematic Coding)

The 11 included articles were analyzed using thematic synthesis. Data were extracted into a structured matrix covering: (a) year of publication, (b) geographic distribution, (c) type of ICT media used (e.g., augmented reality, digital games, video animation), and (d) pedagogical focus. This systematic approach ensured that the "ontological framework" mentioned earlier—where ICT mediates social reality—was consistently tracked across the selected literature.

## 3. RESULT AND DISCUSSION

Composition quests were carried out via the Publish or Perish operation which was limited to the period 2013 to 2023. A comprehensive hunt set up 810 papers from 3 keywords, for the first keyword, videlicet writing" disaster class", the alternate key was written" communication technology", the third keyword was "information technology", and the fourth keyword “early childhood education”.

The study selection process is shown in the inflow illustration figure 1 as shown. This exploration uses the PRISMA (Preferred Reporting particulars for Methodical Reviews and Meta- Analyses) system. Journals were sourced from Scopus and Google Scholar, using the keywords" disaster class"," communication technology"," technology information", and" early nonage education" performing in 810 journals. To further upgrade it by filtering more specifically the disaster class so that the number becomes 9 journals. Next, 9 journals were screened and examined through Methodical Literature Review.

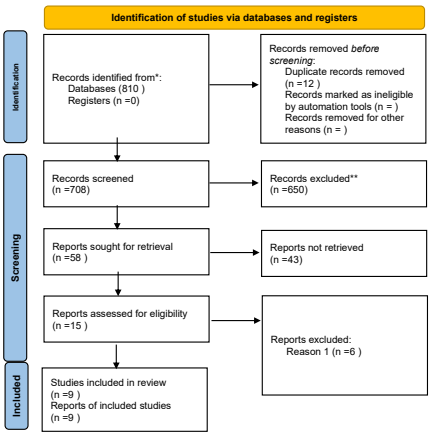


**Figure 1.** Flowchart explaining the process of selecting studies for inclusion

Disasters cannot be controlled, humans can only manage their impact or carry out mitigation. Through disaster mitigation and impact management, the risk of consequences will be reduced. One of the mitigation efforts is carried out through disaster education activities. This educational program is very necessary for everyone, especially people who are vulnerable to disasters. Groups that have quite high vulnerability include the elderly, children and people with special needs. This will greatly reduce the risks of injury, loss of life and psychological problems during and after a disaster.

Disaster education can be carried out through various programs, one of which is through disaster education in educational institutions. In order to implement this disaster education program, one very important instrument is needed, namely the curriculum. With good curriculum design, scope, sequence, continuity, integration, articulation and balance will be met (Hunkins, F. P., & Ornstein, 2018). The existence of a disaster curriculum is a program for students to understand and develop the skills needed to deal with disasters. The urgency of the disaster curriculum in its application goes beyond just providing theoretical knowledge of disasters, such as the meaning of disasters, types of disasters, names. More than that, the curriculum creates a guide for disaster education to train mental management, sensitivity, attitudes and problem solving when a disaster occurs or is affected.

In its implementation, the developing curriculum must keep pace with developments over time. This is based on the fact that we must educate children according to their era. Even at the beginning of preparing the curriculum, of course you have to consider contemporary aspects, that the curriculum speaks for now. In this era of rapid development of information technology, it is inevitable that in formulating the curriculum it takes into account aspects of information technology. For children technology may not provide a full sensory experience. The fear is that children will lose their creativity as they spend more time immersed in digital technology. Despite these concerns, many researchers believe that technology can improve certain skills. This helps the brain process new ideas quickly to improve reasoning and decision-making processes, thereby facilitating innovation.

Based on this, research is motivated to investigate trends in the development of disaster curricula in relation to the rapid development of communication technology and information technology. This research involved analysis of a total of 810 journals collected from trusted sources such as Scopus and Google Scholar. The selection process using the PRISMA method guarantees objectivity and transparency in selecting journals for further analysis. After undergoing the PRISMA stages. 9 journals were identified as worthy and relevant for further exploration. At this stage, the focus of the analysis is to compare the results of these journals, with the main aim of analyzing the

content of the disaster curriculum in children's education in relation to current communication technology and early information technology.

The findings from this analysis can be concluded that, although efforts have been made to compile and develop an ICT-based disaster curriculum, further improvements are still needed. Authors should understand the character and needs of early childhood, especially considering development from all aspects in a comprehensive manner. Through reviewing the results of this research, it is hoped that insight and input can be obtained which will help build the disaster curriculum at Early Childhood Education institutions as an important instrument in disaster education from an early age. This is an effort aimed at preparing children when a disaster occurs or is affected.

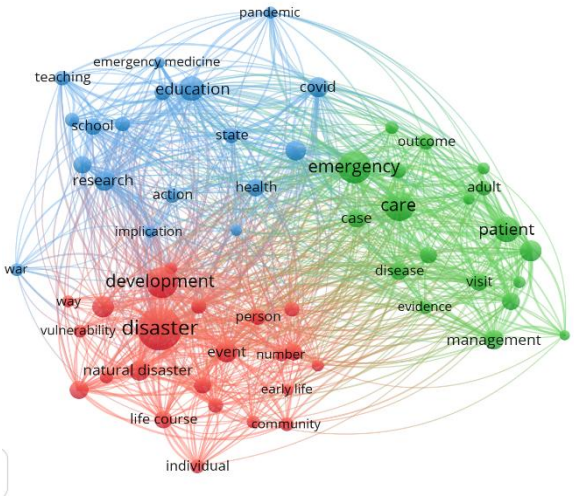


**Figure 2.** Network Visualization with VOSViewer

The use of the VOSviewer tool to analyze journals related to the disaster curriculum provides an interesting overview of this topic, especially in the context of Early Childhood Education. The visualization shows the existence of 4 interconnected clusters, illustrating a comprehensive topic framework.

1. First Cluster: Disaster. This cluster highlights things related to disasters including action, book, case study, change, child, crisis, data, development, disaster, early childhood, early year, example, framework, knowledge, lesson, life course, management, natural disaster, person, policy, practice, research, resilience, risk, role, social medium, theory, and world. Related to disasters, it describes the actions taken by people, including children as victims, who are required to have an attitude of resilience in facing disasters. Knowledge about disasters is important, one of which is supported by literacy media such as books.

2. Second Cluster: Covid. This cluster describes discussions about catastrophe, challenge, covid, distance, e learning, emergency remote teach, experience, face, higher education, learning, medical education, online, online course, online learning, opportunity, pandemic, student, teacher, teaching, term, time and university. Covid that

has hit the world requires everyone to keep their distance. However, the educational process continues with a number of challenges. The trend of online learning and online media is the right time to gain distance learning experience, one of which is through e-learning. Apart from being a disaster for people around the world, this Covid disaster is also an opportunity to change the learning paradigm which can be done remotely.

3. Third Cluster: Information. The fourth cluster discusses care, communication, community, curriculum, effect, emergency department, health, health care, level, life, patient, quality, state, systematic review, training, and treatment. Information is necessary and has a big influence on society regarding the world of disasters. In emergency situations, the accuracy of information is very important for emergency response. ICT plays an extraordinary role in providing speed and accuracy in responding to emergencies. The disaster curriculum has experienced extraordinary development by making ICT an inseparable part of the content and learning media.

4. Fourth Cluster: Technology Communication. This fourth cluster describes technology communication which in the search is recorded in the following words, namely application, approach, communication system, context, country, curriculum, emergency response, emergency situation, ict, icts, information, internet, smart city, strategy, and surveys. Technology communication was developed in the context of risk reducing disasters through various approaches such as integrated communication systems, ICT approaches, emergency application development, information technology-based disaster mitigation curriculum, learning application development, disaster response smart city development, and ICT-based emergency response. The use of communication technology is one strategy for responding quickly during emergency situations. Technology-based information is an effort to reduce the risk of disasters because the speed of information is part of the attitude of anticipating emergency conditions.

Analysis of inter-cluster relationships shows that there are relationships that reflect complexity and significance between topics in the ICT-based Disaster Curriculum in Early Childhood Education. For example, disaster education can help develop creativity in developing digital-based learning media, healthy internet and other information technology insights. Thus, the visualization results with VOSviewer appear to provide rich knowledge about the dynamics and relationships between these important elements. These insights can enrich ideas to become guidelines for improving and perfecting the development of disaster curricula that are more appropriate for early childhood in the current context in the era of communication technology.

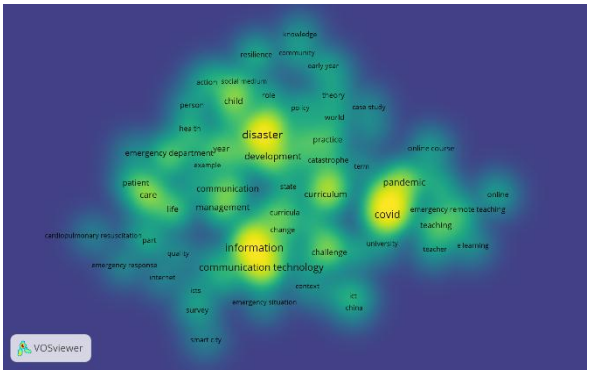


**Figure 3.** Density Visualization by VOSviewer

The significant upward trend in ICT-integrated disaster curricula observed after 2020 suggests a critical ontological shift in early childhood pedagogy. From an ontological perspective, disaster resilience is no longer viewed merely as a set of physical drills, but as a socially constructed reality mediated by digital interaction. The surge in digital media usage reflects a global response to the limitations of physical learning during the pandemic, where ICT served as a vital bridge for simulating high-risk scenarios in a safe, controlled environment. However, this trend also reveals a 'digital-pedagogical gap'; while technology offers immersive experiences, its effectiveness remains contingent upon the teacher's ability to facilitate meaningful dialogue around the digital content. Therefore, the findings imply that ICT media should not replace direct experience but should function as a scaffolding tool that enhances children's cognitive and emotional readiness in facing environmental uncertainties.

In the context of the trend of ICT-based disaster curriculum development in early childhood, the application of analysis through VOSviewer density visualization is the basis for developing content and ideas for curriculum development. The main aim of applying density visualization in this context is to open and expand points of view as well as as a guide in determining priorities. From this visualization, density becomes an illustration for policy makers and disaster curriculum developers to be able to clearly identify areas or topics with high focus or priority. This depiction through visualization can enable curriculum development to concentrate more on the most relevant and critical aspects for deepening understanding. This visualization also helps identify relationships and interrelationships between elements in the disaster curriculum. Through this depiction, it allows curriculum developers to design a coherent and integrated structure because it involves understanding interrelated concepts and topics.

Visualization supports data-driven decision making. This is because using density visualization can help make more informative and data-based decisions. Complex amounts of data can be described and interpreted more easily. This step allows decision makers to identify trends, patterns and potential improvements more quickly. Other goals include optimizing student learning experiences. Curriculum developers can

design disaster-related learning experiences to be more focused and meaningful for students through density visualization. Networking and interconnection make disaster learning easy and meaningful, thereby helping students develop a deeper understanding and introduce skills that are relevant to early childhood in the current context in the era of technological communication. Increasing Transparency and Communication: Density visualization also plays a role in increasing transparency and communication between stakeholders involved in disaster curriculum development. All stakeholders, including the government, school institutions, disaster organizations and the community, can see more clearly the structure and focus of the curriculum. This stage opens up space to facilitate better discussion and collaboration. This visualization also encourages an attitude of always trying to adapt to changes that occur more responsively. This is considering the extent of interconnection which is likely to be influenced by the world of business and renewable technology. This always-adaptive attitude means curriculum developers can quickly adjust content and focus to remain relevant to the latest needs and developments. The evaluation step includes discussing effectiveness and impact. With density visualization, it is very helpful to measure the relevance, effectiveness of the curriculum and its impact on students. By thus monitoring the density of certain elements, curriculum developers can evaluate the extent to which this disaster curriculum can achieve the desired learning objectives.

With this, the use of density visualization in the development trend of ICT-based disaster curricula for early childhood education in early childhood education functions as an important instrument for designing, managing and perfecting the curriculum. This improvement work is carried out so that the disaster curriculum becomes a tool in developing children's abilities and knowledge to know what to do when a disaster occurs and after a disaster.

From the search results, it was decided to review 9 articles as presented in the following table.

**Table 1.** Articles to be Compared

| No | Researcher Name | Article title | Research result |
|---|---|---|---|
| 1. | (Kousky, 2016) | Impacts of Natural Disasters on Children. | Three impacts of natural disasters often occur on children, (1) disasters can damage physical health, be injured or killed, malnutrition, diarrheal disease caused by contaminated water. (2) disasters can cause mental health problems, stress, fear, and sadness. (3) disasters can disrupt education and encourage children to enter the world of work to help their families meet their living needs in difficult times. How can we mitigate these things? One way is to mitigate disasters, for example by strengthening |

| No | Researcher Name | Article title | Research result |
|---|---|---|---|
| | | | school buildings and houses. There are actions that have been proven to help children after a disaster, such as immediately reuniting them with their parents and caregivers. Additionally, using an existing safety net program may be easier, faster, and more effective than creating an entirely new program after a disaster occurs. |
| 2. | Pokhrel & Chhetri, (2021) | A Literature Review on Impact of COVID-19 Pandemic on Teaching and Learning. *Higher Education for the Future* | The education system and the educators have adopted "Education in Emergency" through various online platforms and are compelled to adopt a system that they are not prepared for. The use of suitable and relevant pedagogy for online education may depend on the expertise and exposure to information and communications technology (ICT) for both educators and learners. The flipped classroom is a simple strategy for providing learning resources such as articles, pre-recorded videos, and YouTube links before the class. This is a very effective way of encouraging skills such as problem-solving, critical thinking, and self-directed learning. |
| 3. | Marsh, J., Hannon, P., Lewis, M., & Ritchie, (2017) | Young children's initiation into family literacy practices in the digital age. | Considering socio-cultural developments in the new media era, it is necessary to change the focus from 'family literacy' to 'family digital literacy'. This is because children are immersed in a variety of multimedia and multimodal practices that involve extensive engagement with other family members who play a role in their learning and delight in children's technological capabilities. |
| 4. | Joshua Whittaker, Blythe McLennan, John Handmer, (2015) | A review of informal volunteerism in emergencies and disasters: Definition, opportunities and challenges, | The author discusses the role of informal volunteers in emergency and disaster management. Two types of informal volunteerism are identified which are emerging and which are widespread and their implications for emergency and disaster management are considered. Special attention is paid to increasing 'digital volunteerism' as it becomes easier to access sophisticated yet simple information and communication technologies. Cultural and legal responsibilities were identified as key barriers to increasing informal volunteer participation. We argue that more adaptive and inclusive emergency and disaster |

| No | Researcher Name | Article title | Research result |
|---|---|---|---|
| | | | management models are needed to harness existing capacity and resilience within and across communities. |
| 5. | Didham & Ofei-Manu, (2020) | Adaptive capacity as an educational goal to advance policy for integrating DRR into quality education for sustainable development | Disaster management learning is taught with an adaptive capacity building model that supports pedagogical design, strengthens the learning process for competency development, and may be in line with the main goal of achieving quality education for sustainable development, implementing a well-developed curriculum, improving the quality of teaching methods, building a safe and secure environment. effective. learning environment, and inspiring cooperative and transformative learning. |
| 6. | Sarafova, (2023) | Communicating disasters to children through digital learning activities, geospatial data and flatforms. | Natural disasters can have a significant impact on children's well-being, so it is important to effectively communicate risks and potential dangers to them. The authors outline a holistic, data-driven approach to increasing children's resilience by leveraging geospatial data and maps used in the classroom. Students carry out various practical activities to study natural disasters and their impacts. Kids explore flooding in different regions using a virtual globe, visualize forest fires using a satellite data platform, and study plate tectonics using a virtual globe. Students can also work with the KML dataset containing fault lines and GIS layer points of all earthquakes in the country since the beginning of the 20th century, as well as explore the country's list of landslides using various maps and layers. This activity gives students hands-on experience in using technology and data to understand natural disasters and their impacts. |
| 7. | Rodavia, M. R. D., Curato, I. S. C., & Pitagan, F. B.Rodavia, M. R. D., Curato, I. S. C., & Pitagan, (2018) | Online Disaster Preparedness Application for Kids | The author designed and created an Integrated STEM module with natural disasters, especially earthquakes as a real world situation. The state of disaster literacy is still in its early stages and much still needs to be done to increase awareness of the impacts of natural disasters among school children. The results showed differences between pre- and post-test scores indicating students' mastery and positive feedback from them indicating their acceptance |

| No | Researcher Name | Article title | Research result |
|---|---|---|---|
| | | | of integrated STEM learning. This study provides evidence that these activities have proven beneficial and more efforts should be made in determining STEM curriculum compliance to improve student learning. |
| 8. | Z. Ismail, F. M. Mohamad, H. Harun, N. A. Muda and Y. M. Yusof, (2017) | "Integrated Science, Technology, Engineering, Mathematics Learning in Natural Disaster Earthquake among Form Two Students,". | Research on the use of disaster video games as a learning tool brings together teacher and student perspectives to consider how to encourage children's participation in DRR and support the goals of the Sendai Framework. This paper summarizes a video game research project using three sets of case studies. This process has produced real and meaningful results based on teacher and student needs and offers potential pathways to address gaps in policy and practice to reduce risks associated with disasters. |

ICT media in the Disaster Curriculum is important, especially in the context of learning in the digital era. As young children currently live in the digital era, it is inevitable that they come into contact with digital devices. In order to prepare learning, especially the implementation of the disaster curriculum, the urgency of the ICT-based disaster curriculum for Early Childhood Education is as follows:

1. ICT media functions as a tool/media (means) to achieve disaster education goals increasing access to education, increasing efficiency and the quality of learning and teaching.
2. ICT as access to education in implementing the Disaster Curriculum. The use of ICT will expand the reach and services of education. Distance can be no problem in learning because it uses internet access.
3. ICT in implementing the learning curriculum can increase efficiency. This makes the learning budget more affordable.
4. The quality of learning and teaching becomes better with the use of ICT. ICT also has the potential to be used to teach various abstract, dynamic, difficult subject matter, as well as skills through animation and simulation.
5. Using ICT can stimulate creativity and critical thinking skills.

Thus, the use of ICT in the disaster curriculum that is packaged well by teachers can improve the quality of learning to make it meaningful and enjoyable. However, the usage portion must still pay attention to the child's development..

## 4. CONCLUSION

Children are a vulnerable group who become victims if a disaster occurs. They need more protection than adults in general. However, disasters can happen at any time

and anywhere. It is possible that when a disaster occurs the child is not with his parents. In conditions like this, what parents must do is equip them with knowledge, skills, readiness and resilience. Efforts that can be made are through disaster education.

A good disaster education program is certainly supported by a good, suitable curriculum concept. So the preparation of the disaster curriculum must be adjusted to the development, needs and best things for the child. From a good curriculum, teachers can create good learning, teachers also prepare media, methods and approaches that are suitable for children. In the current context, the curriculum must be friendly to rapid changes, especially those experienced by children. Children now live in a fast flow of information, so teachers must be prepared for these conditions. ICT is a part that begins to be used according to the child's development.

From a systematic search of this literature review, the author found that there are still few studies of the ICT-based Disaster Curriculum specifically for early childhood. A number of literature resulting from studies describe the concept, development and implementation of disaster curricula at higher levels of education, using a conventional approach..

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In conclusion, this systematic review underscores that the evolution of disaster curricula for early childhood from 2013 to 2023 has been increasingly defined by technological integration and multimodal learning. This study successfully maps the global landscape of these trends, demonstrating a consistent alignment between the research objectives and the synthesized findings. The practical implication for

curriculum developers, particularly in disaster-prone regions like Indonesia, is the urgent need to transition from conventional instructional methods to interactive, ICT-based frameworks. By synthesizing diverse global practices, this research contributes a strategic roadmap for designing 'digital-native' disaster curricula that are both scientifically robust and developmentally appropriate for young learners. Future research should prioritize the longitudinal impact of specific ICT tools on long-term disaster-response behaviors to further validate these pedagogical shifts.


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