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Curriculum Development Based on Disaster Mitigation in Schools: A Bibliometric Analysis

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Abstract: Natural disasters are sudden events that negatively impact humans and the environment across various sectors. In the education sector, disasters can disrupt learning processes and cause post-disaster psychological distress among students. Therefore, developing a disaster mitigation–based curriculum is crucial to enhance students' understanding and preparedness. This research aims to identify trends in disaster mitigation–based curriculum development in schools. Using a Systematic Literature Review (SLR) and bibliometric analysis on 108 Scopus-indexed publications (2018–2025), this study found a steady increase in the number of publications. The results show that Indonesia is the most productive country, while Australia is the most cited. Topic cluster analysis revealed four main thematic groups. Indonesia's position in the "Emerging or Declining Themes" quadrant indicates opportunities for further research. Integrating disaster education with local contexts and incorporating local wisdom and technology could serve as potential future research directions.
Keywords: curriculum; school; disaster mitigation; bibliometric analysis

Pengembangan Kurikulum Berbasis Mitigasi Bencana di Sekolah: Sebuah Analisis Bibliometrik

Abstrak: *Bencana alam merupakan peristiwa mendadak yang membawa dampak negatif bagi manusia dan lingkungan di berbagai sektor. Pada sektor pendidikan, bencana dapat mengganggu proses pembelajaran serta menimbulkan gangguan psikologis pascabencana bagi peserta didik. Oleh karena itu, pengembangan kurikulum berbasis mitigasi bencana sangat krusial untuk meningkatkan pemahaman dan kesiapsiagaan siswa. Penelitian ini bertujuan untuk mengidentifikasi tren perkembangan kurikulum berbasis mitigasi bencana di sekolah. Menggunakan metode Systematic Literature Review (SLR) dan analisis bibliometrik terhadap 108 publikasi terindeks Scopus (2018–2025), studi ini menemukan adanya peningkatan jumlah publikasi yang stabil dari tahun ke tahun. Hasil analisis menunjukkan bahwa Indonesia merupakan negara paling produktif dalam menghasilkan publikasi, sementara Australia menjadi negara dengan jumlah sitasi terbanyak. Analisis klaster topik mengidentifikasi empat kelompok tematik utama. Posisi Indonesia yang berada pada kuadrant "Emerging or Declining Themes" menunjukkan adanya peluang besar untuk penelitian lebih lanjut. Integrasi pendidikan bencana dengan konteks lokal, serta pemanfaatan kearifan lokal (local wisdom) dan teknologi, dapat menjadi arah potensial bagi penelitian di masa depan.*
Kata Kunci: *kurikulum; sekolah; mitigasi bencana; analisis bibliometrik.*

1. Introduction

Natural disasters represent severe events with profound impacts on both human populations and the natural environment. All aspects of life can be affected by natural disaster occurrences, including socioeconomic dimension. As a result of climate change, rapid urbanization, and societal vulnerability, we were seeing an increase in the number and severity of disasters globally (Roy et al., 2023; Zhang et al., 2025). According to data from the last decade, 3,570 natural disasters impacted over 134 million people (IFRC, 2015). Beyond the most tragic immediate impact of fatalities, natural disasters can lead to severe long-term health consequences. This includes the emergence of epidemic diseases following a disaster (Lee et al., 2020). Furthermore, higher levels of threat and

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vulnerability correlate with lower capacity, which in turn exacerbates disaster risk. The most tragic consequences of disasters are loss of life and injuries. Additionally, disasters can cause long-term health problems, including infectious diseases due to poor sanitation, malnutrition, and psychological trauma Moreover, natural disasters also contribute to mental health issues, such as post-traumatic stress disorder (PTSD) and depression (Kim et al., 2025). Another example is an earthquake disaster, which can result in deep trauma and psychological disturbances for its victims (Deniz et al., 2025).

Natural disasters can also rapidly damage and devastate infrastructure. Such infrastructure damage can disrupt community activities. Furthermore, extensive infrastructure damage can fatally lead to the possibility of Natech incidents (natural-hazard-triggered technological disasters), which subsequently can cause the release of hazardous chemicals, fires, or explosions (Krausmann et al., 2019). From an economic perspective, natural disasters are formidable events capable of significantly impacting large regional economies. It is known that in 5% of the years when natural disasters occur, a country's economic growth can experience a minimum decline of 0.46 percent, particularly stemming from earthquakes and meteorological disasters (Felbermayr & Gröschl, 2014).

Beyond health and economic consequences, natural disasters also pose long term detrimental effect for education system. For the education sector, natural disasters also have a detrimental impact. Natural disasters causing fatalities, casualties, and significant damage have notably affected school enrollment rates from 1970-2014, both in the short and long term (Kaur et al., 2018). Furthermore, natural disasters lead to disruptions in children's educational opportunities (Gibbs et al., 2019). This is also linked to psychological distress among students (Heanoy, EZ Brown, 2024). Previous research includes a scoping review on the development of disaster mitigation education for the public, (Guo et al., 2025). Additionally, there is research on disaster management in schools, particularly in Taiwan (Wang, 2016). Given the numerous impacts of natural disasters on education, disaster mitigation is deemed essential in schools. Implementing disaster mitigation in schools will enhance students' understanding of disaster types, causes, impacts, and preventive actions (Pascapurnama et al., 2018).

The curriculum is the main foundation in the development of learning. The curriculum plays a crucial role in education, serving as the primary guide to achieving educational objective. The curriculum is a set of concept that consist of a plan and arrangements regarding objectives, content, and subject matter, as well as the methods used as a guide for organizing learning activities to achieve certain educational goals (Fauzan, 2017). The scope of curriculum development is outlined in a structured document known as a curriculum guide, which systematically details all elements of a specific educational program, including its philosophical foundation, desired goals, student objectives, pedagogical approaches, necessary resources, and final assessments (Kranthi, 2017)

. Its implementation in schools must always be adapted to the needs of the surrounding environment (Martin & Simanjorang, 2022).

Previous study explained that DRR education from 2015-2023 has been implemented through various models, methods, approaches, and learning instructions (Tyas et al., 2025). The implementation of disaster risk reduction (DRR) programs, specifically concerning policymaking and curriculum integration, remains a highly relevant area for further research. Furthermore, various modes of DRR integration such as the curriculum development of models that combine technology, pedagogy, and content (TPACK) are also deemed topics worthy of in-depth exploration. Technological approaches to disaster education are also gaining increasing attention. Integrating digital simulations and VR-based disaster learning significantly improved students' risk understanding and decision-making skills (Kimura et al., 2024). Meanwhile, Guo et al. (2025) emphasized that effective disaster education programs increasingly rely on technology-based interactive learning methods to enhance engagement and learning outcomes. In addition, the COVID-19 pandemic has triggered a transformation in education through the increased integration of technology (Salsabila et al., 2023).

A literature review study on curriculum development based on disaster mitigation yields various impacts. Indirectly, the benefits of this research findings can enhance the awareness and concern of both students and school stakeholders (Bugdayci & Cetinkaya, 2022). A critical component of disaster management and disaster risk reduction strategies is the recognition of children's particular vulnerability, along with the imperative to enhance their awareness of disasters. Consequently, the development of awareness-raising instruments that are

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systematically tailored to children's learning needs becomes highly essential (Tibola da Rocha et al., 2020). This bibliometric study can serve as a source of insight and knowledge regarding research trends and knowledge gaps, providing guidance for developing effective educational policies. It supports policymakers and institutions in directing resources and funding toward the most urgent issues in disaster education. In addition, it can also serve as a reference for designing learning methods and models that are appropriate and aligned with disaster education.

Despite DRR policies, teachers often face limited training, a lack of teaching materials, and unclear curriculum guidelines. These findings underscore the urgency of developing a more systematic and well-defined disaster mitigation curriculum framework in schools (Masocha et al., 2025). This research synthesizes prior studies to understand how the development of school-based disaster mitigation curriculum can be effectively implemented. This article aims to address a significant gap in educational research, thereby offering new insights for practitioners and all stakeholders in the education sector to develop curricula that enhance disaster preparedness. This research is as the first bibliometric analysis that specifically maps global research on disaster mitigation-based curriculum development include development of models, methods, approaches, and learning instructions that combine technology, pedagogy, and content (TPACK) in schools, revealing publication trends, influential countries, thematic clusters, and emerging research directions that have not been previously documented. The research questions addressed in this study include:

1. What is the number of/ how many scientific publications in Scopus concerning the curriculum development based on disaster mitigation in schools from 2018 to 2025?
2. Which country is the most productive in research on curriculum development based on disaster mitigation in schools from 2018 to 2025?
3. What are the research trends related to school-based disaster mitigation curriculum from 2018 to 2025?
4. How can the direction of future research in this area be further developed?

2. Materials and Methods

This methodology utilizes a systematic literature review (SLR) by the PRISMA protocol, which adopts the PRISMA Protocol by (Tedja et al., 2024; Lame, 2019) combined with a bibliometric analysis. The research was facilitated by Biblioshiny. Bibliometric analysis was used to identify and evaluate quantitative and qualitative data from various literature sources. This enables researchers to systematically comprehend the landscape of scholarly communication, including the production of literature, the dissemination of publications, the formation of citation networks, and the evolution of thematic trends.

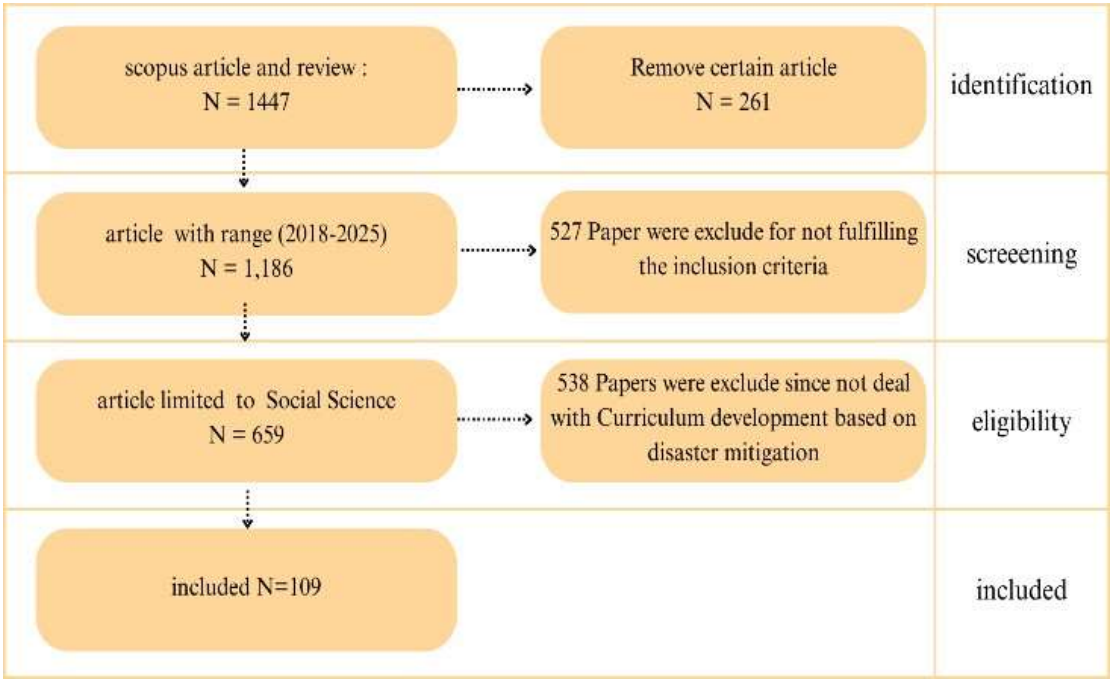

Figure 1 PRISMA-P flow diagram

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The research began with identification stage that identifying articles sourced from the Scopus database which was carried out in June 2025. The focus of this research is the field of Curriculum Development and Disaster Mitigation Integration from 2018 to 2025. The scope of this analysis is broad, encompassing journal articles, books, theses, patents, and even grey literature such as reports. Furthermore, bibliometric analysis provides direction for future research, identifies emerging topics, and assesses the impact of the literature. The database was compiled using the specific keywords: (ALL (curriculum AND development) AND ALL (disaster AND mitigation) AND ALL (school)) AND PUBYEAR > 2017 AND PUBYEAR < 2026).

During the screening stage, only English-language, open-access articles and reviews categorized within the social sciences subject area were included. At the eligibility stage, the metadata of the selected articles was downloaded in BibTeX format, and Biblioshiny was employed to identify the prevailing research trends.

3. Result and Discussion

Scientific production

The analysis of curriculum development based on disaster mitigation began by exploring publications indexed in Scopus from 2018 to 2025. From the analysis results, of 659 research publications were found, 108 research publication were then analyzed in depth. Many publications were eliminated because most of them were disaster preparedness in others sectors not in education sector. Based on Figure 2, the PRISMA research flowchart, it is shown that from the 108 publications related to disaster - mitigation - based curriculum development

Figure 2. Number of Documents by year based on Scopus data from 2018 to 2025

Figure 2. illustrates a significant increase in research publications from 2021 to 2025. Overall, there is a sharply rising publication trend from 2020 to 2025. Figure 2 shows that research publications with the theme of curriculum development based on disaster mitigation in school, which was affected by the number of disasters that occurred during that time (Tyas et al., 2025). However, the increase is not evenly distributed across the different types of hazards. The types of hazard that are most often integrated in curriculum development are climate change, earthquake, flood, landslide, tsunami, covid-19, and others. The hazard most frequently integrated into curriculum development is climate change. This is due to the extreme increase in global temperatures. This situation has led to more frequent extreme weather and climate events, causing millions of people to experience severe food insecurity and reduced water availability, with the most significant impacts (IPCC et al., 2023). In addition, biological disasters such as COVID-19 and Ebola have also become topics in the development of disaster-mitigation-based curricula. COVID-19 in particular has affected the learning process in many countries. This is consistent with previous studies showing that, due to the COVID-19 pandemic, schools and universities were closed, causing learning change from offline to online formats and requiring the curriculum to be adjusted (Pinar, 2021).

Table 1. Types of Disaster Included in Curriculum Development

Types of Disaster Included in Curriculum Development	Qty
Earthquake	7
Climate Change	48
Flood	3
Landslide	4
All hazard	31
Fire	2
Covid	3
Tsunamis	3
Others	2

Based on Table 1Types of Disaster Included in Curriculum Development, it is shown that the type of disaster most frequently integrated into curriculum development is climate change, whose frequency far exceeds that of other disasters. This indicates a strong focus on environmental threats over a long-term period. However, other types of disasters such as floods, landslides, fires, and tsunamis are underrepresented. This suggests that there is still a lack of curriculum development that prioritizes

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local hazards. Therefore, there is an opportunity for future research to expand the coverage of disaster mitigation for other types of threats so that the curriculum becomes more comprehensive

The Most Productive

There are ten countries with the highest levels of scientific productivity based on the 108 scientific publications analyzed in the figure 3.

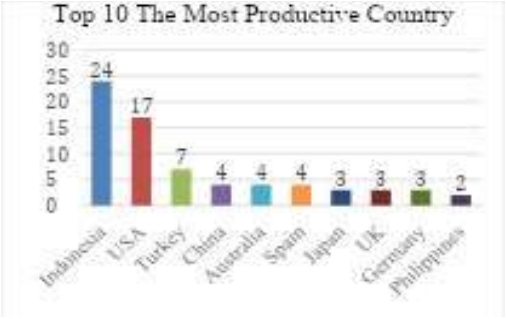

Figure 3The Most Productive Country

Figure 3 shows that Indonesia is most productive country, having generated 24 units. Following Indonesia, the USA produced approximately 17 units, Turkey 7 units. Other countries with significant production levels include China (4 units), Australia (4 units), Spain (around 15 units), the UK (3 units), Japan (3 units), Germany (3 units) and Philippines (2 units). This indicates that Indonesia plays a crucial role in scientific publications related to curriculum development based on disaster mitigation. It is in line with the previous before that the understanding that knowledge of disaster mitigation is essential for all segments of Indonesian society, given that Indonesia is a country highly vulnerable to natural disasters (Taufan Maulana & Andriansyah, 2024). According to previous reports, Indonesia, China, and the Philippines are classified among the top 10 countries with the highest disaster risk (IPCC et al., 2023). Furthermore, according to the Climate Risk Index (Germanwatch, 2025), the United States and Spain were among the countries most affected during the period 1993–2022.

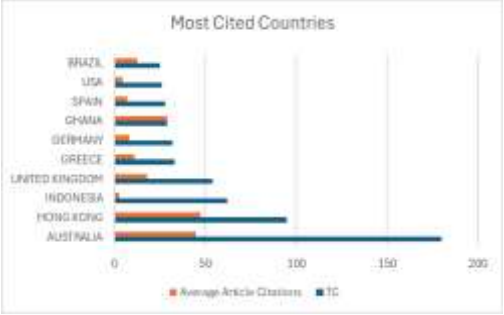

Figure 4 The Most Cited Country

Based on the analysis, Australia holds the top position as the most cited country. Subsequently, Hong Kong and Indonesia rank second and third, respectively, as can be observed in Figure 4. Figure 4 displays the most cited countries graph, which illustrates the total citations (TC) and average citations per article for several nations. Australia emerges as the country with the highest total citations, followed by Hong Kong and Indonesia. These results indicate the significant influence and quality of scientific works related to this topic.

The Research Trends Related

Research trends related to the development of disaster-mitigation-based curriculum in schools integrated with TPACK can be observed from the following graph. Curriculum development serves as the foundation for the entire learning process, while TPACK is considered effective in facilitating technology-enhanced learning (Santos & Castro, 2021). Therefore, this study analyzes the role of TPACK in the development of disaster-mitigation-based curricula in schools.

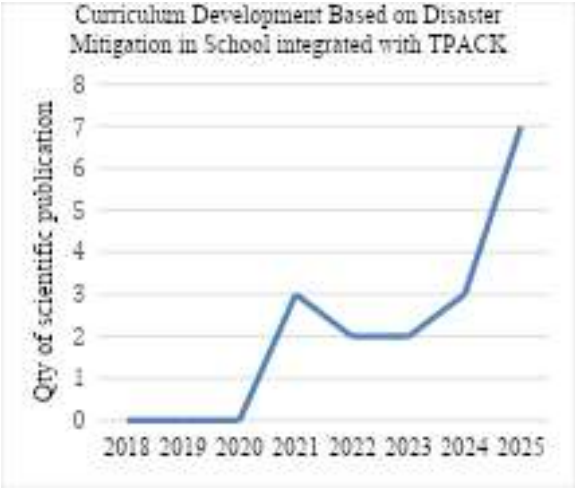

Figure 5. Curriculum Development Integrated with TPACK

Overall, the graph shows an increasing trend in studies on the implementation of TPACK in disaster-based curriculum development, particularly after 2021, with a significant rise in 2025. This growth is influenced by the educational transformation that has increasingly integrated technology since the COVID-19 pandemic, which is consistent with findings from previous research (Salsabila et al., 2023). The integration of TPACK in disaster-based curriculum development is implemented through the development of learning media. Technological approaches can enhance students' attention, which in turn

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improves their understanding and decision-making skills. This is consistent with previous studies showing that integrating digital simulations and VR-based disaster learning significantly improves students' risk awareness and decision-making skills (Kimura et al., 2024)

Research trends related to Curriculum Development Based on Disaster Mitigation in Schools were analyzed using network visualization and emerging themes as shown in Figure 6 and 7.

Figure 6. Network visualization related to curriculum development based on disaster mitigation

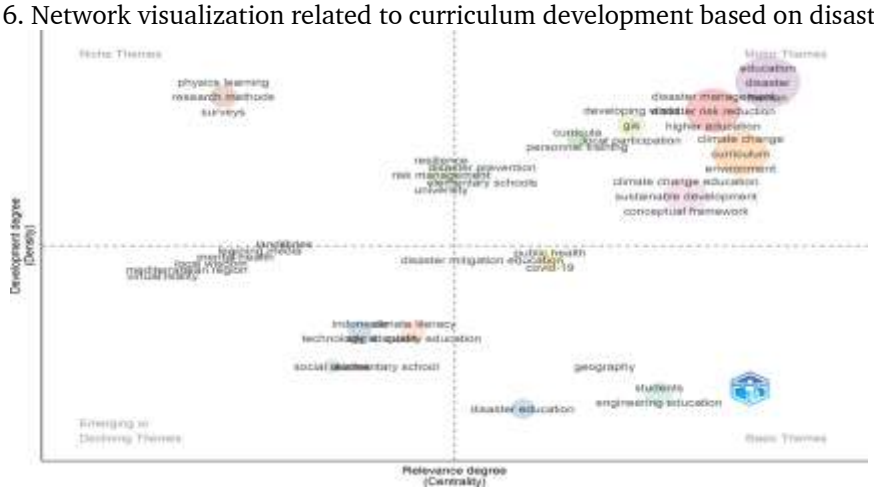

Figure 7. Bibliometric Shiny visualization on an emerging theme.

This figure illustrates the interdisciplinary nature of this research field, encompassing education (environmental and risk), sustainability, and disaster mitigation/ management. The orange/yellow cluster represents a strong core, and the interconnectedness between clusters signifies extensive collaboration and cross-referencing among these sub-fields. There are four main clusters: the orange cluster, the green cluster, the purple cluster, and the blue cluster. The orange cluster forms the research core, focusing more post-disaster psychological impacts, and disaster risk reduction. This aligns with previous research indicating that natural disasters can have psychological effects on children (Funakoshi et al., 2014). The purple cluster contains themes related to inclusive education, disaster risk education, and public health concerning disasters. Finally, the blue cluster covers disaster research, emergency management, and evaluation within the public health context.

Figure 7 illustrates that Motor Themes encompass highly relevant and rapidly developing core topics, including education, disaster risk management and reduction, and sustainability. Niche Themes, which are relevant but less developed, include student-focused topics, technical education, geography, and disaster education. Emerging Themes, representing newer areas, cover landslides, mental health, learning media, local wisdom, and virtual reality. Indonesia's presence in this quadrant suggests that research related to the country within this context may still be in its developmental stages and requires further connectivity. Consistent with previous research, Indonesia is categorized as a country with a high

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level of disaster vulnerability (IPCC et al., 2023). This condition is attributed to its geographical position along the Ring of Fire, which not only provides significant potential for geothermal development but also exposes the country to various natural hazards such as earthquakes and tsunamis (Dauglas & David, 2017).

Further research

Future research should aim to integrate disaster education with local Indonesian Emerging or Declining Themes quadrant, there's a significant opportunity for research to make a substantial impact. This is particularly crucial as Indonesia's location within the Ring of Fire makes it highly vulnerable to seismic and hydrological disasters (Roque et al., 2024)

Further in-depth research and the establishment of connectivity networks with Indonesia are compelling options due to the country's significant growth potential in this field. Researchers could further explore the psychosocial and mental health impacts of disasters in schools. Studies are needed to develop curricula that integrate aspects of psychological first aid and mental health support for both students and teachers in the aftermath of natural disasters, aligning with findings that natural disasters have detrimental psychological effects on students (Funakoshi, S., 2014).

Another promising research theme involves innovative approaches to developing a holistic disaster education curriculum for students. This would encompass practical simulations, drills, and community engagement. Studies on this topic would also actualize the role of geography and physics studies in strengthening disaster mitigation efforts in schools. Additionally, future studies could be conducted collaboratively across sectors and disciplines. For example, research could investigate how disaster education curriculum development strategies might be integrated with aspects of local wisdom.

4. Conclusion and Suggestions

A bibliometric analysis of research on disaster mitigation-basedcurriculum development within the Scopus database from 2018 to 2025 revealed 108 scientific publications. Overall, the graph shows an increasing trend in studies on the implementation of TPACK in disaster-based curriculum development, particularly after 2021, with a significant rise in 2025. There was a steady increase in publications, establishing Indonesia as the most productive country, while Australia emerged as the most cited country. Future research potential to extensively explore disaster education in Indonesia, which can be integrated with local wisdom and technological advancements.

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