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Effectiveness of Disaster Education Programs in Senior High Schools: A Study of Implementation and Impact in Indonesia, China, The Philippines and Thailand

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ABSTRACT

Background: Disasters are unavoidable emergencies that will be difficult to handle by those affected, especially without outside assistance. Disaster preparedness is a real necessity in this country, especially for earthquakes.

Objective: Review research related to disaster management in school children in the four countries of Indonesia, China, Thailand, and the Philippines, with Thailand having the least knowledge of disaster management.

Methods: Study analysis through 5 electronic databases (pubemed, since direct, google scholar, connective paper, and Scopus). In the first stage 65 articles, at the last search there were 9 studies included.

Results: The Philippines implemented a disaster risk reduction management (DRRM) curriculum program incorporated in the Philippine Act of 2010 into the school curriculum. Indonesia developed a disaster management mobile application program, and Indonesia implemented the SSSB instrument program. China implemented a geography curriculum program that includes geography as a compulsory course in schools. Thailand implemented the school safe community (SSC) program.

Conclusion: Disaster education in senior high schools is important to build a culture of safety and resilience. School preparedness in the face of natural disasters is crucial. Disaster impacts include casualties, environmental damage, and psychological effects that need to be considered.

Keywords: *education, disaster, high school, students*

1. INTRODUCTION

Natural disasters are unpredictable events that are beyond human control, difficult to predict, and often cause major losses that exceed the ability of affected communities to cope without external assistance. Disasters can originate from natural, non-natural, or human factors, causing significant disruption to people's lives, the economy, the environment, and causing casualties, material losses, and psychological impacts (1) . Disasters are now a frequent global phenomenon, affecting many aspects of life, including health, social, economic and education. The impacts include morbidity, mortality, damage to shelter, macroeconomic weakening, material losses, and damage to infrastructure, which directly disrupt people's lives (2) . Exposure to disasters, both natural and non-natural, is often associated with mental health impacts such as post-traumatic stress (PTSS), anxiety and depression (3)

In the past 2 decades, the number of natural disasters has increased dramatically around the world. Natural disasters such as earthquakes, floods and tsunamis have affected a large number of people around the world. Disaster risk depends on the type of hazard, exposure and vulnerability. Vulnerable groups exposed to disasters face greater hazards and risks in their lives. Children are one of the most vulnerable groups. Education can be classified into formal, non-formal and formal education (4) An earthquake is a sudden shaking of the earth caused by an unexpected release of energy from the lithosphere. It can cause tsunamis, which are the displacement of large amounts of water due to movement of the earth's crust (5)

Natural disasters are estimated to kill 90,000 people per year and affect more than 160 million people worldwide. They have a direct impact on human life and often result in the degradation of the physical, biological and social environment of the affected people, resulting in long-term impacts on their health, well-being and survival.Due to their scale and vulnerability, the Asia Pacific region experiences the most natural disasters (6) The average frequency of disasters due to natural disasters worldwide was 13% higher in 2021 compared to 1991, causing huge economic losses. The Emergency Events Database recorded 387 global disasters, causing 30,704 deaths and impacting 185 million people, with economic losses of approximately USD 223.8 billion. According to the World Health Organization, in May 2023, there were more than 766 cases (7) . Earthquakes and tsunamis cause massive loss of life. An estimated 1.35 million people died in 7000 disasters worldwide between 1996 and 2015, of which 56% were earthquake and tsunami victims (8) . There are approximately thousands of disasters recorded around the world to date that have caused massive loss of life and people (9).

There have been 504 earthquakes in the world during 2000-2017. In Europe in 2000-2017 there were 891 natural disasters, of which 34 earthquakes (average 5.7 on the Ritcher scale) affected 13 other countries, mainly Italy and Greece resulting in 701 deaths and 257,303 people affected (10). A disaster-prone area requires effective disaster warning management. This is because destructive disasters usually have negative impacts (11). In recent years, Thailand has faced many major natural disasters. These include the Indian Ocean Tsunami in 2004, floods in 2011, an earthquake in 2014, droughts in 2015 and 2016, as well as challenges such as reduced rainfall, declining fisheries and agriculture, and rising sea levels. In particular, Chiang Rai's northern mountainous region was most affected Chiang Rai was also hit by an earthquake in 2014, which resulted in the destruction of 115 school buildings. Subsequent floods, droughts and landslides have made the region's population even more vulnerable, especially children, to challenging conditions (12).

The Philippines is a country with a high vulnerability to natural disasters. According to international reports, the Philippines is ranked third out of 173 countries vulnerable to disaster risks. This evaluation is based on the potential for natural disasters to cause heavy loss of life, damage to property and infrastructure, and degradation of human well-being such as health status and livelihoods. In addition to the impact of disaster risk, the country is also vulnerable to the effects of climate change. The Philippines is a disaster-prone country due to its geographical location. The archipelago is located on the Pacific Ring of Fire making it prone to geological natural disasters such as volcanic eruptions and earthquakes. The Philippines is also highly vulnerable to various meteorological hazards. The country lies in the path of tropical cyclones which can be categorized as tropical depressions, tropical storms, severe tropical storms, typhoons and super typhoons(13) . The most frequent disasters in the Philippines are typhoons, which are most likely to cause injury, death, and property damage (14). Based on a report by Mamon et al. (2017), female students in the Philippines showed higher levels of disaster preparedness than male students, reflecting gender differences in risk perception and preparedness.

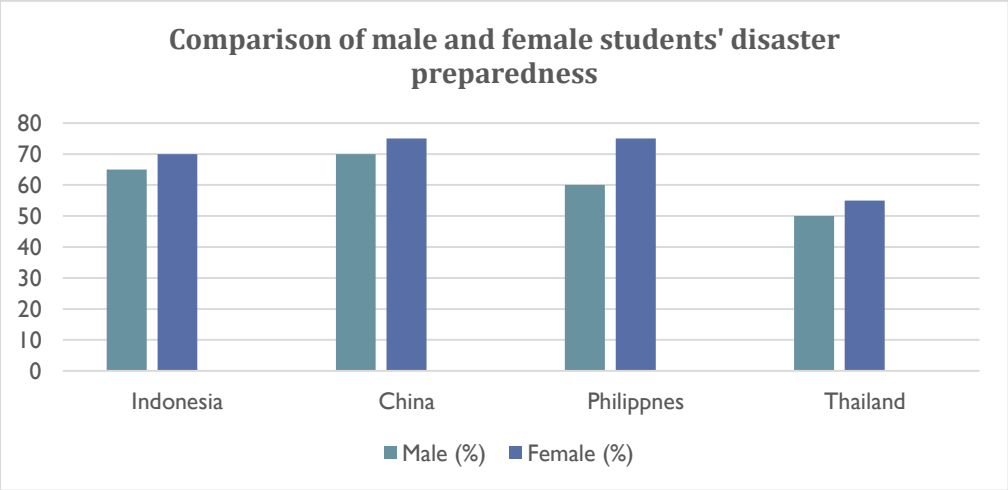

Figure 1. Comparison chart of male and female students' disaster preparedness in four countries: Indonesia, China, Philippines and Thailand

This graph shows that female students tend to have higher preparedness than male students in all countries, with significant variations in Thailand. However, data from Wongsuriyanan & Tsuchida (2023) shows that male students in Thailand are more likely to experience disaster-related stress due to lack of access to disaster education.

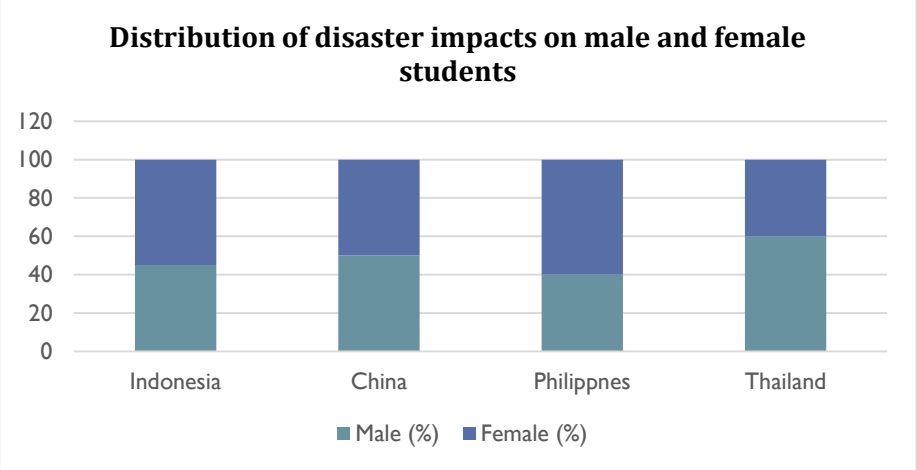

Figure 2. Distribution chart of disaster impacts on male and female students in four countries: Indonesia, China, Philippines and Thailand

Indonesia, as the world's largest archipelago at the confluence of four tectonic plates, is prone to significant natural disasters. In 2018, there were 4,231 fatalities from natural disasters, with one of the largest earthquakes occurring in Aceh in 2004, measuring 9.1 on the Richter scale, which killed 170,000 people. In addition, the 2022 Cianjur earthquake (M5.6) caused 268 fatalities, and the 1917 Bali (M6.6) claimed 1,500 victims. Based on DIBI, earthquake occurrence increased from 28 events in 2020 to 63 events in 2021(15) . The resulting psychological, economic and sociological impacts can have a long-term impact on a community. The psychological impact of disasters can lead to cognitive problems with memory and attention or mentally revisiting or imagining the disaster(16) . a common phenomenon, the frequency of disasters has been increasing since the beginning of the 20th century. Disasters stem from a combination of two factors, the first being natural phenomena capable of causing physical damage and loss of human life and capital, while the second consists of the vulnerability of individuals and human settlements .(17)

Based on Law No. 24/2007 article 26 paragraph (1) letter b and Government Regulation No. 21/2008 article 14 paragraph (2), the community is entitled to education, training and skills in disaster management, which can be implemented through formal, non-formal and informal education. Disaster management includes four main phases: preparedness, mitigation, response and recovery, with preparedness aiming to anticipate disasters through efficient organization and action. Disaster preparedness education, including in schools, is an important necessity to reduce the unavoidable impacts of disasters(18) . There are various efforts and research underway to prevent disasters and make the world's population more resilient to disasters (19) . Disaster response action refers to the coordinated efforts made by individuals, organizations and governments to mitigate the impact of disasters and provide assistance to those affected by them .(20)

Educational institutions play a role in knowledge transfer to promote community resilience and sustainable development, including through disaster education that empowers students to recognize danger signs and reduce disaster risks(21) . Children spend most of their time in a week in the school environment and therefore there is a need to consider inclusive disaster risk reduction (DRR) in schools(22) . Education can be one of the strategic and effective efforts to reduce earthquake risk(23) . Schools are important institutions in public health preparedness plans, serving as evacuation sites, participatory education centers, and sources of disaster-related information, and readily adopting policies for crisis preparedness, response, and recovery(24) . The goal of disaster education is 'to build a culture of safety and resilience at all levels,' to reduce the adverse social and economic impacts of hazards(25) . School preparedness for natural disasters and biological events is critical(26) . Disaster Risk Reduction uses knowledge as well as education and innovation to create a culture of safety and increase resilience .(27)

Preparing for disasters can minimize losses due to natural disasters, especially for children whose numbers are increasingly affected by climate change. Disaster resilience education in schools is an important solution to improve the understanding, mitigation skills and preparedness of school communities through increasing the capacity of human resources, as well as the readiness of physical infrastructure. This education integrates theory and practice with a family, school, and community-based approach and schools can also serve as centers for disseminating health information and disaster education(28) . As it is found that there are about thousands of disasters recorded worldwide to date that have caused many human and human casualties due to earthquakes, it is very important to conduct a literature study related to disaster education in high schools. So this study wants to review research related to disaster management in school children in the 4 countries of Indonesia, China, Thailand, and the Philippines, Thailand which has very little knowledge about disaster management.

2. METHODS

The method used in this research involved a study through five electronic databases, namely PubMed, ScienceDirect, Google Scholar, Connective Paper, and Scopus. In the first stage, 65 articles were found, but after the final screening, only 9 studies were included using inclusion and exclusion criteria. **Inclusion criteria** included: the data used were from the last 13 years, obtained from the five databases mentioned, only related to disaster program education and its impact on high school students, and located in China, the Philippines, Indonesia, and Thailand. **Exclusion criteria** included: articles that did not have a complete structure, did not address disaster program education and its impact on high school students, did not fit the research objectives and questions, or were literature reviews.

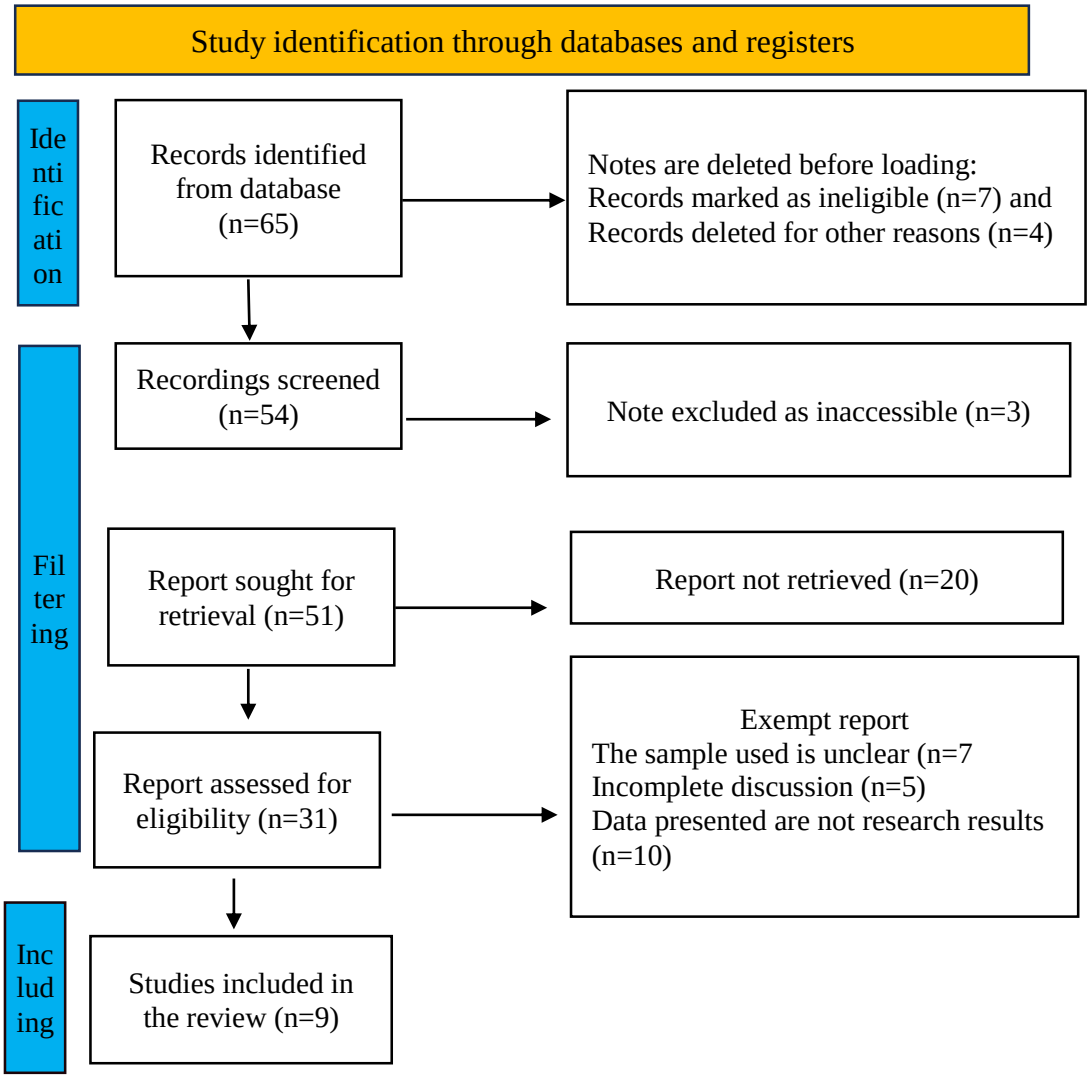

Figure 3. Flowchart of Study Selection

Table 1. Research Overview

Author	Sample	Findings
Song J. et al. (29)	High school students	• most students think that informative and easy-to-use web maps need to be introduced in DRR education. • They can identify risk areas more accurately using web hazard maps, which shows that DRR education should utilize modern technology.
Gong Q et al.	High school	This research examines the evolution of Disaster Risk

(30)	students	Reduction (DRR) content in geography curricula in China, which continues to evolve to encompass knowledge, action and participation, with curriculum reforms emphasizing the relevance of DRR in improving preparedness and reducing the impact of natural disasters.
Wongsuriyanan & (31)	High school students	VI students worry and fear disasters due to orientation difficulties. These concerns may affect students' self-control.
Mamon et al. (13)	High school students	High school students have a high level of knowledge, preparedness, adaptation and awareness related to disasters.
Seyle et al. (32)	High school students	• This research shows that post-disaster interventions can reduce teacher stress. • Factors such as gender and teacher education can affect disaster response.
Cabuga & Canete (21)	High school students	High school students in the Philippines have a high level of disaster-related knowledge. There was a significant difference in preparedness between females and males, with females showing higher preparedness.
Amri et al. (33)	High school students	The majority of children recognize the hazards around them, while teachers consider child-friendly training and materials important for DRR education, although some disagree with children's active involvement in preparedness planning.
Lassa et al. (34)	High school students	• This research highlights 20 years of disaster risk reduction experience in Toineke village, Indonesia. • Communities take adaptation measures such as the construction of flood embankments and food diversification. • A community-based approach (CBDRR) is used by involving NGOs and local governments.
Li J. & Xiaoyang X(35)	High school students	Web GIS is used effectively in natural disaster education to strengthen teacher-student interaction.

3. FINDINGS

Table 2. Comparison of disaster education implementation in four countries Indonesia, China, Philippines and Thailand

Country	Key Strategies	Excellence	Challenge	Recommendation
Indonesia	Mobile application, SSSB (Safe School Safe Building)	Improve students' technological literacy	Evaluate the impact of the app on student behavior	Integration of technology into the formal curriculum
China	DRR in the geography curriculum	Holistic approach	Relevance of content to real-life situations	Use of technology, such as Web GIS
Philippines	DRRM (Disaster Risk Reduction Management) Curriculum	Improved student preparedness	Gender-based preparedness inequality	More inclusive education

Country	Key Strategies	Excellence	Challenge	Recommendation
Thailand	Safe School Community (SSC) Program	Internationally recognized program	Uneven distribution in rural areas	Local community engagement

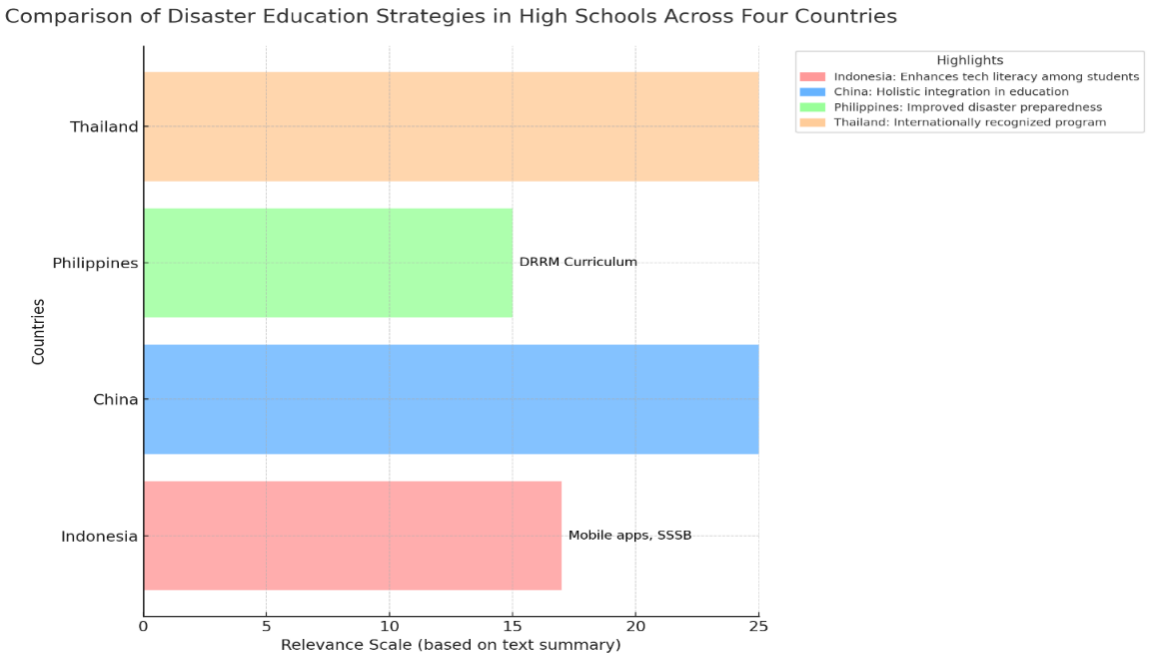

Figure 4. Relevance Scale Graph Comparison of Disaster Education Strategies in High Schools in Four Countries

Disaster preparedness education can be done early in school so that children know how to avoid and save themselves from disasters(36) Disaster Risk Management (DRR) is a series of efforts made to analyze and reduce the risk of disaster impacts on human life and livelihoods.expand_more DRR is not only about responding to disasters after they occur, but also about prevention and preparedness measures to minimize their impact. (34). The Disaster Management Cycle first emerged in the early 1970s and was created to illustrate the continuous process that governments, companies, and civil society undertake in preparing for and reducing the impact of disasters, responding during and immediately after disasters, and taking actions to recover. (20)

The United Nations International Strategy for Disaster Reduction (UNISDR) mentions and establishes the fact that effective DRR education in the upper secondary education curriculum establishes and strengthens a culture of awareness, preparedness and resilience among students. They are the most vulnerable victims of disasters where the risks can affect them physically, emotionally and psychologically. Disaster education aims to increase students' resilience to disaster risks by solidifying knowledge about disasters, developing skills that can be used to prepare for, adapt to, mitigate and respond to the damaging impacts of disasters, and raising awareness that broadens the scope of understanding about disasters. (13)

Although natural disasters have been recognized as a life-saving threat, understanding of disaster risk management is still limited. This literature review examines how these four countries Indonesia, Philippines, Thailand, and China came up with programs that can help communities to reduce the impact of natural disasters. Indonesia is the country that has experienced the most natural disasters with the most frequent occurrence in Yogyakarta in the south of Central Java, Indonesia. In May 2006, the area was struck by a major earthquake measuring 6.3 on the Richter scale and causing significant and widespread destruction including more than 5,000 deaths and the displacement of nearly 140,000 families whose homes were destroyed. (32)In addition, Indonesia is geographically located on the tectonic plates of Australia, the Pacific, Eurasia and the Philippines, making the country vulnerable to climate change which makes it prone to geological disasters such as earthquakes, tsunamis, volcanoes, landslides. (37)

The education of these four countries differs starting with Thailand Children in Thailand have little opportunity to build capacity to deal with potential disasters because disaster education and practice in schools is not compulsory. The social education and life skills curriculum in schools is only intended for students to deal with daily difficulties. (31)While for

China, the Philippines and Indonesia, the education of children in these areas varies depending on the supporting factors, which can be economic, environmental, and local policies.

Meanwhile, in the Philippines, the Department of Education (DepEd) has incorporated the Philippine DRRM Act of 2010 into school curricula and other educational programs to initiate Disaster Risk Reduction Management (DRRM) and increase students' level of resilience to natural disasters. The program includes activities, advocacy programs, and simulation programs to enhance Disaster Risk Reduction (DRRM) to develop the level of disaster preparedness in students. The program aims to increase students' knowledge and awareness of disaster reduction and management, and engage schools as the right place to get information on how to avoid and mitigate disasters such as earthquakes and fires. (38)

The Indonesian government has developed a mobile application for disaster management. This mobile application is one of the efforts in the education program to increase public awareness of disaster management. School education is also mentioned as one of the most effective ways to sensitize people on Disaster Risk Management (DRR) from a young age. In addition, a quiz on school safety was also introduced as part of the education program, which was answered by 128 students. (29). And in Indonesia, this SSSB instrument was created to assist schools and the National Education Office in assessing school resilience through a multi-hazard approach. The development of the SSSB instrument was done through a series of steps: 1) developing conceptual definitions, 2) developing operational definitions, 3) determining scaling techniques, 4) reviewing item justifications related to predetermined scaling techniques, 5) determining response formats, 6) preparing response instructions, 7) preparing instrument drafts, 8) preparing final instruments, 9) collecting preliminary pilot test data, 10) analyzing test data using factor analysis, item analysis, and reliability analysis, 11) revising instruments (if needed), 12) conducting additional validity and reliability analyses, and 13) preparing test guides. The scope of this publication is data analysis using factor analysis, item analysis and reliability analysis (39)

China has a geography curriculum program that includes geography as a compulsory subject in primary schools and integrated into social subjects. In secondary schools, the geography curriculum covers various topics such as physical geography, regional development and environment. The geography curriculum in China has been reformed to address content relevant to (DRR), including an understanding of community resilience and the social dimensions of disaster risk. Geography subjects in China aim to integrate the study of natural and human realities with a focus on space, place, and region, addressing and questioning short- and long-term processes and the patterns they produce. Therefore, a geography curriculum integrated with DRR can help improve students' understanding and awareness of disaster risks and the risk reduction measures that need to be taken before, during and after (30).

In Thailand, the "Safe School, Safe Community" (SSC) program was launched by the Thai Ministry of Education in 2008 with the aim of increasing the resilience of schools and communities to natural disasters. The program includes various activities, such as: Training for teachers and school staff on natural disaster preparedness, Provision of disaster-resistant infrastructure in schools, Development of evacuation and emergency response plans in schools, Education and training for students on natural disaster preparedness, Community involvement in natural disaster preparedness activities. (31),

The SSC program has been implemented in more than 20,000 schools across Thailand and has proven effective in improving natural disaster preparedness and response in schools and communities. The program has been internationally recognized as an example of best practice in natural disaster preparedness education (31),

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