

Disaster resilience education in international primary textbooks: a quantitative content analysis

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Abstract. Indonesia's geographical position on the Pacific Ring of Fire makes it highly vulnerable to natural disasters, highlighting the urgency of Disaster Resilience Education (DRE) from an early age. This study investigates how DRE is represented in international primary textbooks in Yogyakarta, Indonesia. Using a qualitative design, the study applies discourse analysis to examine how language constructs knowledge, ideologies, and perceptions of disasters. Twelve textbooks from grades 1-6 were analyzed, but only one contained disaster-related material, comprising five relevant passages. Using a 0-3 scale across four DRE elements (Hazard Knowledge, Risk Awareness, Preparedness and Mitigation Actions, and Response Skills), the analysis showed a strong emphasis on Hazard Knowledge (total score=12), moderate inclusion of Risk Awareness and Preparedness Mitigation (5 each) and a minimal focus on Response Skills (1). The results indicate that while basic hazard literacy is present, textbooks lack practical, behavioral needed for disaster readiness. This study contributes empirical evidence of a gap in DRE integration in international schools and highlights the need for curriculum improvement to support disaster preparedness in primary education.

1 Introduction

Indonesia is highly vulnerable to natural disasters particularly earthquakes, volcanic eruptions, tsunamis, floods, and landslides, due to its location on the Pacific Ring of Fire and a high-risk natural disaster index [1]. The risk becomes higher because many people live in areas at high risk of natural disasters, leading to high impact when disasters occur. Thus, disaster readiness and preparedness are vital because they save lives, reduce material damage, and foster community resilience. Low levels of community awareness of disaster causes higher risk if disasters come. Disaster preparedness especially critical communication elements need to be conducted in all levels of the community to enhance disaster response. Several steps can be done as mitigation steps toward disaster readiness and preparedness. Creating forum of disaster risk reduction can be initiated in the level of community [2].

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Disaster Resilience Education (DRE) can also be done in formal education level starting from early age education until high education levels.

DRE teaches students to understand local hazards, their effects, and how to take protective actions before, during, and after a disaster [1]. The main goal is to promote public safety, to a lesser extent, reduce damage. Several key aspects are included in the DRE namely hazard literacy, impact understanding, skill development, problem-solving, community engagement, and participation [28]. Hazard literacy is the ability to understand, evaluate, and respond to different types of hazards, such as natural disasters in order to make informed decisions and take appropriate precautions [2]. Meanwhile, impact understanding requires children to recognize direct effects (deaths, injuries, property damage), secondary effects (hazardous material releases), and indirect, long-term consequences (economic disruption, mental health issues, social inequality exacerbation) [3]. In addition, disaster skill development refers to the process of building technical, practical, and soft skills to prepare for, respond to, and recover from disaster. Moreover, problem-solving community engagement becomes a structured approach to address local issues by involving community members in the process of identifying problems, developing solutions, and implementing them collectively. One important role of students as the target of DRE is their participation that refers to the active engagement of communities and individuals in all phases of disaster risk reduction, preparedness, and response, including decision-making, planning, and implementation of mitigation and recovery efforts [4].

Those key elements can be a basis for education institutions to apply DRE for students. In fact, DRE program has been implemented by schools in Indonesia starting from early age education until high school level. Schools have applied several efforts in DRE by integrating disaster knowledge into school curriculum. Integration of learning in schools has become an educational pathway to raise disaster awareness among community members. Local wisdom can also be included in disaster education in Indonesian schools to increase community awareness in disaster mitigation [5]. Integrating disaster risk reduction (DDR) into school curricula is crucial for building resilient communities and achieving the goals of the UN Sendai Framework by stronger policy development, implementation, and coordination as well as innovative and holistic approaches to embed DDR in education. Students' text book can reflect the integration of DRE. A study conducted in Turkiye found that disaster risk reduction as another step of DRE in the early stages of education and noted a prevailing perception of disasters as natural and unavoidable events [6]. To enhance learning outcomes, textbooks on disaster mitigation need to include contextually relevant material, appealing visual support, and clear, accessible language [7].

Previous study has conducted a need analysis on Disaster Mitigation-Based Textbooks in Indonesian Language Learning, and it found that the integration of DRE in textbooks should strengthen both language acquisition and disaster readiness. Meanwhile, this study focuses on analyzing DRE-related textbooks in Primary International Schools in Indonesia. The study needs to be conducted because international schools primarily use English as their instructional language. Comprehensive study needs to be done to understand whether the information related to natural disasters can be thoroughly understood by the students and then applied in their actions related to disasters. The main purpose of the study was to quantitatively investigate the level of DRE appears in the textbooks used as the main

materials in international schools in Indonesia by using a rubric and coding system that measures five dimensions of disaster exposure. Hence, three research questions appear in the study:

1. To what extent do the passages in the textbooks contain DRE elements?
2. Which DRE dimensions (hazard knowledge, risk awareness, preparedness and mitigation action, response skill) appear most and least frequently in the passages?

Based on the research questions above, the study aimed to quantify the presence of DRE elements in the passages from the textbooks (1) and to analyze emphasized or missing aspects of DRE in the textbook passages (2).

2 Methods

The study employed a quantitative content analysis to examine the extent to which DRE elements are embedded in the textbooks as the main materials in the classes. Quantitative content analysis is a research method that systematically alters qualitative content into numerical data to identify patterns, trends, and relationships. The process can be achieved by using a structured coding scheme to count and categorize specific features, which then can be analyzed statistically [8]. In this study, each DRE dimension was converted into numerical scores to measure the presence, depth, and distribution of DRE content.

The data were taken from 12 textbooks used in the classes; those are English and Science books which may contain more information about DRE. However, among those books, only Science 4 book contains passages related to disasters, and the other 11 textbooks do not discuss any material related to disasters. Thus, the author analyzed one book as the main research material. The lack of disaster-related content across the majority of textbooks is itself a crucial indicator of inadequate DRE integration in international curricula, creating the analysis of the only relevant textbook a critical starting point for identifying gaps. In the only book as the main source of the analysis, the author found five (5) passages which contained disaster-related topics such as volcano eruptions, seismograph, and earthquakes. In this study “passage” refers to a self-contained segment of the text that discusses the concept related to natural disasters.

To systematically measure the range of DRE context, the study employed a structured coding rubric to quantify disaster-related dimensions within each passage. The coding scheme was adapted from Sendai Framework for Disaster Risk Reduction 2015-2030 including (1) understanding disaster risk coded by Hazard Knowledge (HK), (2) strengthening disaster risk governance to manage disaster risk coded by Risk Awareness (RA), (3) investing in disaster reduction for resilience coded by Preparedness and Mitigation Actions (PA), and (4) enhancing disaster preparedness for effective response coded by Response Skills (RS). During the process, each dimension was scored using a 0 – 3 scale to ensure objective, replicable measurement across passages.

Table 1. Scoring scale

Score	Descriptor
0	Not present

Score	Descriptor
1	Mentioned minimally
2	Clearly described with examples
3	Strongly emphasized, detailed, repeated

The analysis proceeded through several steps including (1) familiarization by reading the passages multiple times to obtain a general understanding of its content, (2) application of coding rubric by scoring every passage independently using 0-3 scale, (3) verification by reviewing to ensure internal consistency, (4) quantification by processing a structured dataset and summing to obtain totals for each DRE dimensions in every passage, and (5) cross-comparison by comparing all the passages to identify the gaps. The coding procedure can be drawn by this following graph:

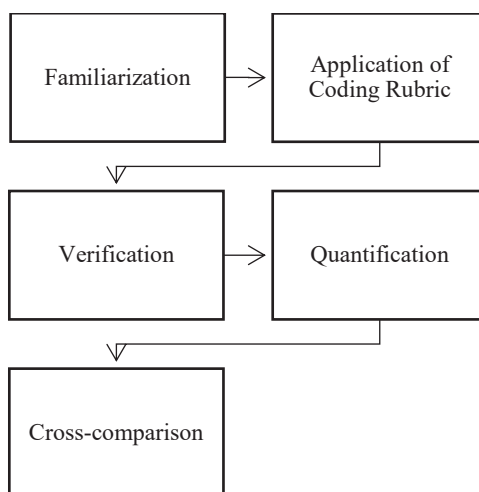


Fig.1. Coding procedure graph

After conducting coding procedure, the data were analyzed using descriptive quantitative techniques, including the frequency counts of each DRE score, total scores for each DRE dimension, section-level totals to compare passages content and graphical visualization including bar charts or pie charts. These analyses were used to interpret how comprehensively the textbook integrates DRE principles.

This study examined publicly accessible textbook content. No human contributors were involved, thus the study posed no ethical risks. Appropriate citation and acknowledgement of the textbook as the basis material were maintained through the research.

3 Results and discussion

3.1 Results

Among twelve (12) textbooks that have been analyzed, only can the researchers find one book that contain disaster-related material. Disaster-related vocabularies are taught in

Cambridge Primary Science Learner’s Book 4 only. Other books do not discuss materials related to disasters. Meanwhile, in the book, there are five (5) passages discussing about natural disasters namely 3 passages on volcano eruption and 2 passages on earthquake. The researchers categorized four main DRE variables as the basis of analysis namely Hazard Knowledge (DRE1), Risk Awareness (DRE2), Preparedness and Mitigation Actions (DRE3), Response Skills (DRE4).

Table 2. Summary of coding results for all five passages

No	Passage	DRE1	DRE2	DRE3	DRE4	Total
1.	Volcano Eruption	3	2	0	0	5
2.	Dormant & extinct volcanoes	1	0	0	0	1
3.	Earthquake causes & tectonics	3	2	1	0	6
4.	Seismologists & seismographs	3	0	2	0	4
5.	Earthquake-prone zones & building design	2	1	2	1	6
	Total	12	5	5	1	

Meanwhile, the visualization of coding results is also presented in the following chart.

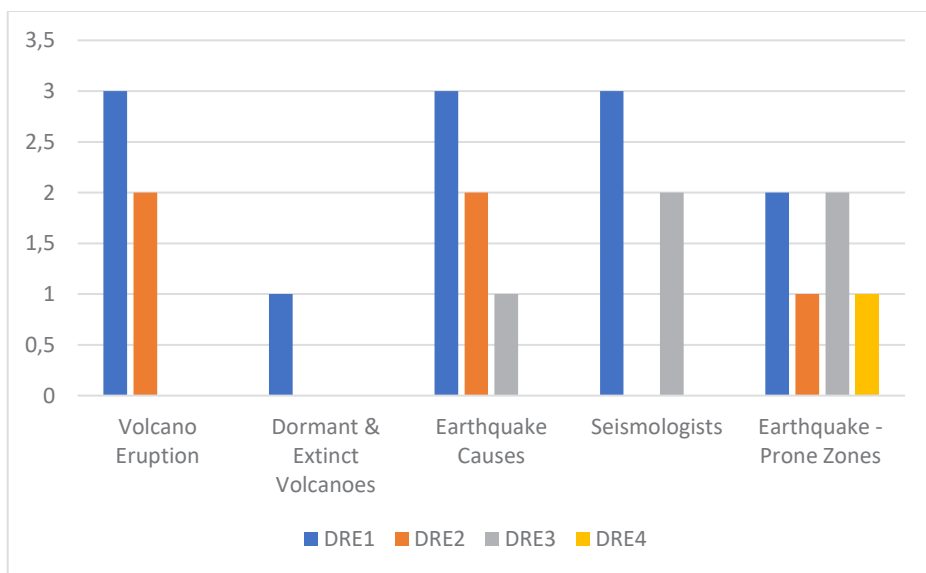


Fig.2. Summary of coding results

Based on the table and the graph, the scores show significant variation across passages, with some underlining scientific explanations while others contain insignificant disaster-related content.

Meanwhile, Table 3 presents the total scores for each DRE dimension across the five passages to understand the aspects of DRE are emphasized.

Table 3. Total scores by DRE dimension

No	DRE Dimension	Total Score	Interpretation
1.	DRE1 – Hazard Knowledge	12	Very strong scientific detail
2.	DRE2 - Risk Awareness	5	Moderate emphasis
3.	DRE3 - Preparedness and Mitigation Actions	5	Moderate presence
4.	DRE4 – Response Skill	1	Highly limited

Hazard knowledge (DRE1) dominates all other categories, indicating an instructional focus on scientific mechanism rather than practical or emotional preparedness. The high score indicates that the textbook prioritized cognitive and scientific understanding of hazard, aligning with Sendai priority 1: Understanding disaster risk, but mainly from a geological science perspective rather than a community or live-experience perspective. Some examples from the passages that show DRE are “When volcano erupts, it sends up molten rock called lava;” “When the plates stop moving and then start again suddenly, this causes an earthquake.” The sentences in the passage represent strong knowledge explanation related disasters.

Risk awareness (DRE2) appears moderately but lacks depth. Students are told that disasters are dangerous but not how risks manifest in real situations. This partially supports Sendai’s call for fostering risk perception, but it is not fully associated with the holistic risk understanding required for effective disaster risk reduction. The examples of the Risk Awareness based on the passages are “We cannot stop volcanoes from erupting. They are a natural event. The lava destroys everything it touches;” “This is a natural disaster that can cause buildings to fall.” In fact, the passages explain risk awareness about natural disasters, but they do not mention the it deeply.

Preparedness and Mitigation Actions (DRE3) are included in the passages, but they are narrow. The textbook teaches that preventive measures exist but does not equip learners with personal or actionable skills such as clear safety procedures, community-level preparedness, and evacuation or shelter strategies. The focus is limited to building design, not comprehensive preparedness. The theme of disaster preparedness and mitigation can be found in the passages such as “We cannot stop natural disasters. We can only try to build homes that will stay standing in an earthquake”. The utterances become the only aspect of the passages that discuss about how to prepare and mitigate disaster.

Response skills (DRE4) is the most underrepresented category. The passages contain almost no actionable steps for what students should do during the disasters. The descriptions of emergency response behavior, early warning systems, evacuation planning, and communication protocols are absent. This absent reveals a critical gap in the teaching material. This directly contradicts Sendai Priority 4: Enhancing Disaster Preparedness for Effective Response.

3.2 Discussion

The analysis highlights strengths and gaps in the textbook’s integration of disaster-related content across five passages in the textbook. The results show that Hazard Knowledge

(DRE1) obtained the strongest emphasis. This points out that the textbook highlights the geological conceptions, technical processes, and descriptive hazard instruments. Such highlights support the cognitive aspect of DRE recommended in Sendai Priority 1, which stresses understanding hazards as a basis for risk reduction. Scientific literacy is one of the components in developing a more resilient and well-informed society ability of effectively addressing the challenges posed by natural disasters [9]. By studying the scientific principles of these natural phenomena, students can better understand the conditions and likelihood of disasters [10]. Nevertheless, the material mostly remains within the science curriculum, without adequately connecting scientific understanding to practical life skills.

Although risk consciousness exists, the total score (5) shows that it is not adequately developed. The passages describe damaging impacts in general terms, but do not contextualize geographical, social, and cultural risks. This gap is significant because Sendai framework encourages understanding in connection with vulnerability and exposure. Without localized or human-centered examples, students may view disasters as distant scientific events rather than real-life threats. This argument supports stating that DRE should enhance community capacity to prevent and respond to disaster through participating in disaster-themed science classes [11].

Preparedness and mitigation actions also scored a moderate 5, but these are mostly limited to structural concepts of earthquake-resistant buildings and predicting building stability. However, the findings show that fundamental aspects of personal safety behaviors, evacuation planning, early warning interpretation, and community roles in preparedness were absent. These aspects play a crucial role in minimizing the loss of lives and reducing damage to infrastructure by providing accurate information on impending threats [12]. Sendai priority 3 highlights investment in risk reduction including education that equips individuals with preventive behavior.

The most crucial finding is the near absence of response skills (Score = 1). Students are not provided with fundamental behavioral guide in terms of evacuation routes, safe meeting points, volcanic ash protection, and emergency communication steps. It contradicts Sendai Priority 4 stressing to enhance the preparedness for effective response at all education levels. Without such information, students may have scientific knowledge but no capability to act during emergencies. The study conducted emphasize the importance of DRE because it is the only effective way to prevent disasters or reducing its effects by increasing community response skills through all education level [13-15].

The results have to be viewed within the context of international schools in Indonesia, which generally adopt the Cambridge curriculum. This curriculum focuses scientific explanation over localized disaster readiness, resulting in content that describes natural phenomena but does not convert them into practical safety actions. As a result, students in a disaster-prone country may accept content that is scientifically global but practically separated from their local risk setting.

4 Conclusion

The study investigated the scope to which DRE components are integrated into science textbooks used in primary international schools in Indonesia. Although twelve textbooks

were studied, only Cambridge Primary Science Learner's Book 4 contained disaster-related content, and only five passages within this book discussed disaster-related topics. Using a quantitative content analysis and a rubric aligned with the Sendai Framework's priority aspects, the study evaluated four DRE aspects namely Hazard Knowledge (DRE1), Risk Awareness (DRE2), Preparedness and Mitigation Actions (DRE3), and Response Skills (DRE4).

The results disclose a prominent imbalance in DRE representation. Hazard Knowledge (DRE1) received the strongest highlight, with a total score 12. Risk Awareness (DRE2) and Preparedness and Mitigation Actions (DRE3) both obtained a moderate score (5 each), signifying that some elements are present, but they lack depth and practical relevance. The most critical gap lies in Response Skills (DRE4), which got the lowest score (1). As a result, students may develop scientific knowledge of disasters but remain underprepared to perform life-saving activities during real situations.

This imbalance proposes a requirement for curriculum developers and international schools to implement a more comprehensive approach to DRE by integrating intellectual understanding and actionable skills as well as contextualized risk awareness. The main message of this study is that disaster education in international primary schools textbooks risks remaining theoretical rather than life-saving.

The study has several limitations. Only one textbook was found to contain disaster-related content, which constrains the coverage of analysis and avoids comparison across grade levels. The focus of Cambridge Primary Science materials cannot characterize other international curricula used in Indonesia.

It is recommended that future curriculum and textbook development should embed clear behavioral guidance, context-specific risk examples, and response procedures for primary students. Strengthening disaster preparedness and responses in teaching materials will help ensure that students can understand and be equipped to respond effectively when disasters happen.

Acknowledgements

Thanks to all parties who have helped to conduct the study especially LPPM Universitas 'Aisyiyah Yogyakarta.

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