

NEEDS ANALYSIS FOR DEVELOPMENT OF AN ILLUSTRATED STORYBOOK ON EARTHQUAKE MITIGATION TO ENHANCE CHILDREN'S DISASTER LITERACY

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Abstract

Disaster literacy is a critical component of early childhood education, particularly in earthquake-prone regions such as Bengkulu, which lies along the active Sumatran Fault Zone and experienced two major earthquakes (M 7.9) in 2000 and 2007. Despite this persistent risk, most early childhood education (ECE) institutions in Bengkulu have not integrated contextual learning media into their programs, leaving children's understanding of disaster largely abstract. This study analyzed the need for a Bengkulu-context picture storybook to build earthquake-mitigation literacy in early childhood. A qualitative descriptive approach was applied, involving 15 ECE teachers in Bengkulu City through a structured questionnaire and semi-structured interviews, analyzed using frequency distribution and the interactive model of Miles & Huberman. Storybook use in ECE remains limited and dominated by generic themes unrelated to local hazards; only two schools (13%) owned an earthquake-mitigation storybook, 73% of teachers reported difficulty developing their own instructional media, and all teachers (100%) expressed a need for a Bengkulu-context storybook drawing on local architecture and cultural heritage. A picture storybook grounded in Bengkulu's geological identity and cultural heritage is proposed as a contextually authentic medium for cultivating disaster preparedness from an early age, alongside a teacher's guide that addresses the accompanying competence gap.

Keywords: Early Childhood, Disaster Literacy, Earthquake Mitigation, Picture Storybooks, Local Context.

INTRODUCTION

Indonesia is among the most disaster-prone countries in the world because of its geographical position at the meeting point of three major tectonic plates: the Eurasian, Indo-Australian, and Pacific plates. This tectonic setting produces a very high frequency of seismic activity; the Meteorology, Climatology, and Geophysics Agency (BMKG) recorded 7,358 earthquakes across Indonesia in 2024 alone, 186 of which had a magnitude of ≥ 5.0 and posed a potentially destructive threat (BMKG, 2025). This threat is not merely a statistic; it is a daily reality faced by millions of Indonesians, including young children (Hutchings & Mooney, 2021). Bengkulu is one of the provinces with the highest earthquake risk in Indonesia. It lies along the Sumatran Fault Zone, an active fault system stretching more than 1,900 km that splits Sumatra from the northwest to the southeast (Salman et al., 2020). Two major earthquakes have struck Bengkulu within the past two decades: the 2000 earthquake (M 7.9), which caused hundreds of fatalities and thousands of damaged buildings, and the 2007 earthquake (M 7.9), which again produced widespread infrastructure damage and loss of life (Natawidjaja, 2018). Bengkulu also carries a legacy of traditional wooden architecture with flexible joint systems (Rumah Bubungan Lima), historically regarded as more resistant to seismic shaking than concrete construction (Fathani et al., 2019). This combination of high seismic exposure and distinctive local heritage makes Bengkulu a rich and relevant context for developing disaster-education media for young children.

Building awareness of earthquake risk from an early age is a critical foundation for long-term community resilience. The Sendai Framework for Disaster Risk Reduction 2015-2030 explicitly calls for the active involvement of children in disaster risk reduction as agents of change, rather than merely as a vulnerable group to be protected (UNDRR, 2020). A quasi-experimental longitudinal study by Yildiz et al. (2024) found that children who received a structured disaster-education program over 18 months showed significantly more accurate risk perception and higher preparedness than a control group, confirming that early disaster education functions as a long-term investment in survival capacity rather than a supplementary activity. Disaster literacy in early childhood, understood as the ability to recognize hazard cues, understand basic protective actions, and develop emotional preparedness for disaster

events, therefore needs to be cultivated deliberately rather than left to incidental exposure; cross-country survey evidence indicates that children's disaster knowledge and preparedness vary systematically with the amount of hazard education they have actually received, not with disaster exposure alone (Yildiz et al., 2022). Young children between birth and six years of age are in a critical period of brain development and of laying cognitive, emotional, and social foundations (UNESCO, 2022). During this period, children learn optimally through direct experience and concrete representation connected to their immediate surroundings (Vygotsky, 1978). Vygotsky's concept of the zone of proximal development holds that children reach deeper understanding when guided by a more competent adult or peer, which makes scaffolding through well-designed media central to effective learning (Wood et al., 1976). In the context of disaster education, young children cannot grasp abstract concepts such as an "active fault" or a "seismic wave" without visual and narrative mediation suited to their level of understanding. The constructivist perspective similarly holds that knowledge is actively built by children through interaction with their environment (Piaget, 1964), so that content closely tied to children's real, lived surroundings is more easily internalized and retained over the long term (Fauzi & Suryani, 2022).

Picture storybooks have repeatedly proven effective for delivering abstract or unfamiliar content to young children. They integrate visual and narrative elements multimodally and build the emotional response and empathy that strengthen the retention of safety information (Mancilla-Martinez & Beck, 2023; Solfiah et al., 2020). Kartika et al. (2023) found that disaster-themed picture storybooks significantly improved children's understanding of earthquake evacuation procedures compared with lecture-based instruction, while Rahmawati and Hidayat (2023) found that storytelling using characters and settings familiar to children produced better information retention and a more positive emotional response. Storybooks that use realistic characters and settings have also been shown to improve children's ability to transfer knowledge from the story to real situations more than storybooks with fantastical elements (Skene et al., 2022; Strouse et al., 2018). Together, these findings support the development of a storybook explicitly rooted in a specific local context, such as Bengkulu, rather than one built around generic or imported settings. Bengkulu's suitability for such a story book rests on several intersecting characteristics. Geologically, Bengkulu sits directly above the most active segment of the Sumatran Fault Zone, giving children in the region a statistically higher probability of earthquake exposure than children in many other parts of Indonesia (Salman et al., 2020). Architecturally, the Rumah Bubungan Lima demonstrates that flexible wooden construction can meaningfully reduce seismic damage, providing a concrete, child-comprehensible principle of "what makes a house safe in an earthquake" that a storybook can translate directly into narrative form (Fathani et al., 2019). Culturally, Bengkulu holds a rich body of local folklore that can serve as a narrative frame so that mitigation messages are delivered through a medium already familiar to children. Finally, the region's collective experience as a community that has survived major earthquakes constitutes a form of social capital and survivor knowledge that can be woven into a storybook's narrative to build children's sense of agency and resilience (Natawidjaja, 2018). Taken together, these four dimensions give a Bengkulu-context storybook a distinct source of novelty relative to disaster-education media developed for other regions.

Despite this potential, a review of the literature shows that most disaster-education media currently available in Indonesia remain generic and are not rooted in specific local contexts (Setiawan et al., 2021; Solfiah et al., 2020). Existing Indonesian ECE disaster media illustrate the pattern: Nurani et al. (2022) developed a digital instructional video to introduce flood mitigation to young children, and Khaerudin and Suharto (2022) proposed a general disaster-education model for preschool-age children both valuable, but neither anchored in a specific region's geology, architecture, or cultural heritage the way this study's needs analysis suggests teachers actually want. Earthquake-mitigation storybooks specifically are scarcer still in ECE institutions, and teachers face a dual barrier: limited knowledge of disaster concepts and limited competence in developing instructional media on their own (Lee et al., 2023). As a result, disaster-mitigation learning in ECE still relies heavily on verbal methods that are poorly matched to how young children learn (Pratiwi & Rahma, 2020). The development of storybooks grounded in a specific local context particularly in seismically active regions with a distinct body of local wisdom, such as Bengkulu remains largely unexplored in the literature, leaving a clear and practically consequential gap.

This study addresses that gap by analyzing the need for a Bengkulu-context picture storybook as a medium for building earthquake-mitigation literacy in early childhood. Specifically, the study examines (1) the current condition of storybook use and availability in Bengkulu's ECE institutions, (2) teachers' competence in developing their own instructional media, and (3) teachers' perceived need for, and expectations of, a Bengkulu-context earthquake-mitigation picture storybook. Bengkulu's geological character, its earthquake-resistant architectural heritage, and its local cultural wisdom together provide the distinct source of novelty that differentiates this study from similar research conducted in other regions.

METHOD

This study used a qualitative descriptive approach aimed at gaining an in-depth understanding of a real-world phenomenon from the perspective of the research participants (Creswell & Creswell, 2018). This design was chosen because the study sought to identify the actual condition of instructional-media use and the needs of ECE teachers in implementing earthquake-mitigation education an inquiry that required exploring nuance and context that a purely quantitative approach could not capture on its own. This study represents the first stage (needs analysis) of a larger Research and Development (R&D) project that follows the ADDIE model (Analysis, Design, Development, Implementation, Evaluation); the present article reports only the Analysis stage. Participants were 15 ECE teachers working in early childhood institutions in Bengkulu City, selected purposively based on the following criteria: (1) at least one year of teaching experience in ECE, (2) active use of instructional media in daily teaching, and (3) willingness to participate voluntarily. The participating institutions included both public and private kindergartens located across the three most densely populated districts of Bengkulu City, so as to capture some diversity of school resourcing and setting. Approval was obtained from the researchers' home institution, and participant confidentiality was maintained throughout by using participant codes (P1-P15) rather than names in all data records and in this report.

Data were collected in two stages. The first stage used a structured questionnaire consisting of 20 closed-ended items covering four aspects: (a) frequency of storybook use in daily teaching, (b) availability of disaster-themed storybooks at the respective school, (c) teachers' self-assessed competence in developing instructional media, and (d) teachers' perceived need for a locally contextualized storybook. The second stage involved semi-structured interviews with eight teachers purposively selected to represent the range of questionnaire responses observed (rather than only the most positive or most negative cases), so as to deepen understanding of teachers' perceptions, barriers, and expectations regarding earthquake-mitigation media. Questionnaire data were analyzed descriptively through frequency distributions and percentages for each item. Interview data were analyzed using the interactive model of Miles, Huberman, and Saldaña (2014), comprising three interconnected activities: (1) data condensation, i.e., selecting, focusing, and transforming raw transcript data through thematic coding; (2) data display, i.e., organizing coded information into structured matrices and narrative summaries to reveal patterns across participants; and (3) conclusion drawing and verification, in which emerging themes were checked against the full data set for consistency. Coding moved from descriptive, close-to-the-data labels toward broader categories in successive passes through the transcripts, consistent with standard qualitative content-analysis practice (Erlingsson & Brysiewicz, 2017). Source triangulation was applied throughout by systematically comparing questionnaire results against interview findings, so that a theme was treated as credible only when it was supported by both data sources a strategy for strengthening the credibility of qualitative findings through multiple data sources (Natow, 2020).

To strengthen the credibility of the findings, two additional safeguards were applied during coding. First, a portion of the interview transcripts was coded independently by two members of the research team, and differences in code assignment were reconciled through discussion, reducing the risk that a single coder's assumptions would drive the thematic categories reported below. Second, the research team deliberately checked the data set for statements that contradicted an emerging theme, so that the patterns reported in the following section reflect the balance of evidence across all 15 teachers rather than only the most vivid or memorable quotations. Data collection took place within a single semester, so that each teacher's reported storybook use reflects an ordinary rather than an exceptional period of classroom practice. Participants were informed of the study's purpose and their right to withdraw at any time, and all recordings were stored securely and accessed only by the research team.

RESULTS AND DISCUSSION

3.1 Storybook Use and Availability in Bengkulu ECE Institutions

Table 1 presents the needs-assessment results in summary form; these figures are treated as the raw, first-layer findings that the remainder of this section interprets.

Table 1. Summary of Needs Assessment (n = 15 teachers)

Indicator	n	%
Teachers who have used storybooks in learning activities	9	60%
Teachers who use storybooks routinely (>3x/week)	5	33%
Schools owning an earthquake-mitigation storybook	2	13%
Teachers able to develop instructional media independently	4	27%

Teachers reporting difficulty developing instructional media	11	73%
Teachers who need a Bengkulu-context picture storybook	15	100%

Source: Researchers' analysis (2026)

Of the 15 participating teachers, 9 (60%) reported having used storybooks in their teaching, yet only 5 (33%) used them routinely, more than three times a week indicating that storybooks are not yet firmly established as a primary instructional medium in ECE settings, but rather an occasional supplement. Availability of earthquake-themed storybooks specifically was even more limited: only 2 of 15 schools (13%) owned one. This gap is striking given that Bengkulu is one of Indonesia's most earthquake-prone provinces, where early disaster-mitigation education would be expected to be a curricular priority rather than an afterthought left to individual teacher initiative.

This pattern is consistent with Setiawan et al.'s (2021) systematic review, which found that disaster-education media in Indonesian ECE settings tend to be adopted opportunistically by individual teachers rather than embedded in a school-wide curriculum, leaving their use highly uneven from one classroom to the next. The near-absence of earthquake-specific storybooks compounds this unevenness: even the teachers who are motivated to use storybooks regularly have, in practice, little earthquake-relevant material to reach for, so a general storybook habit does not automatically translate into disaster-education exposure for children.

3.2 Teachers' Competence in Developing Instructional Media

Beyond the shortage of ready-made media, most teachers reported difficulty developing instructional materials on their own: only 4 teachers (27%) felt capable of creating their own media, while 11 (73%) reported difficulty, citing limited understanding of disaster content, limited design skills, and limited facilities and supporting resources. Read together, these figures point to a competence gap that runs along three separate dimensions content knowledge about earthquakes and mitigation, pedagogical judgment about what is developmentally appropriate for young children, and the technical production skills needed to actually design and produce a usable artifact (Gerde et al., 2018). Any single-dimension intervention for example, providing teachers with disaster facts alone, or with a design template alone is therefore unlikely to close the gap on its own; the three dimensions need to be addressed together.

This finding aligns with Gerde et al.'s (2018) observation that self-efficacy in developing instructional materials among early-childhood educators is rarely a matter of general teaching skill alone, but depends on specific, often under-supported training in both content knowledge and media design. Because this kind of specialized training is not a routine part of general ECE teacher preparation, the competence gap identified here is unlikely to close simply through further classroom experience; it calls for a deliberate capacity-building component to accompany any storybook that is eventually developed, rather than an assumption that teachers will adapt the material unaided.

3.3 The Case for a Bengkulu-Context Picture Storybook

All 15 teachers (100%) expressed a need for a Bengkulu-context picture storybook as a medium for earthquake-mitigation education. This full consensus was the study's most significant finding. It was not only pragmatic teachers wanting a ready-to-use resource that would save them preparation time but also pedagogical: teachers specifically wanted a medium that could concretely connect children's real experience to disaster concepts, rather than a generic import. One participant (P7) explained that teachers were aware children need to learn about earthquakes but lacked a suitable book, since most books available in the market covered animal stories or fairy tales rather than earthquakes or disasters. This statement points to an unmet need that teachers are already well aware of, alongside the structural barriers, documented in the previous section, that prevent them from meeting it on their own.

Interview data further revealed that teachers link this need directly to locality rather than to disaster content in general. Participant P3 explained that a book telling the story of an earthquake in Bengkulu, illustrated with houses resembling those in the local area, would make it easier for children to understand and to feel that the story was about them. This reflects the principle of contextual learning (Fauzi & Suryani, 2022), which holds that connecting instructional content to children's lived experience is a precondition for meaningful learning, not merely a stylistic preference.

The consistency between the full (100%) questionnaire response and the spontaneous way teachers raised locality in their own words during interviews, as in P3's remark above, suggests that this need is not simply an answer teachers gave because it seemed expected on a form, but a considered judgment grounded in day-to-day experience of trying, and failing, to find suitable material. Setiawan et al. (2021) similarly note, from their review of Indonesian ECE disaster-education practice, that such initiatives are more likely to be sustained by educators when they are perceived as addressing a concrete, recognized gap in daily practice rather than being externally imposed; the pattern

observed here teachers naming a specific, unmet need rather than passively accepting whatever material happens to be provided to them is consistent with the kind of ownership that sustains long-term use of an instructional resource once it exists.

Thematic analysis of the eight interviews identified three recurring elements of Bengkulu's local context that teachers considered most relevant for the storybook, summarized in Table 2.

Table 2. Thematic Categories of Local-Context Elements Identified by Teachers

Category	Elements identified by teachers
Setting	Fort Marlborough, Tapak Paderi Beach, typical Bengkulu homes and schools
Characters	Locally dressed child characters reflecting Bengkulu's cultural diversity
Mitigation actions	Moving from stone/concrete buildings to open fields or flexible wooden structures

Source: Researchers' thematic analysis of interview data (2026)

These three categories setting, characters, and contextual mitigation action moved consistently together across the eight interviews: teachers who emphasized familiar settings also, in the same breath, emphasized locally dressed characters and locally relevant safety actions. This pattern suggests that, for these teachers, "local context" is not a single, isolated design feature to be added on top of a generic story, but a coherent narrative logic that has to run through the setting, the characters, and the plot's safety actions at the same time.

3.4 Local Wisdom as a Cultural Tool for Mediating Disaster Understanding

Interestingly, teachers rarely mentioned Bengkulu's local wisdom on their own initiative as a resource for disaster education, even though the region holds directly relevant traditional knowledge. The Rumah Bubungan Lima is a clear example of vernacular seismic technology, developed by earlier generations of Bengkulu communities to withstand earthquake shaking: its wooden construction, flexible joints, and foundation designed to allow lateral movement have proven more adaptive to seismic waves than rigid concrete structures (Fathani et al., 2019). Read through Vygotsky's (1978) concept of cultural tools the artifacts and practices through which a community mediates a child's understanding of its environment this architectural heritage functions as more than a safety lesson: it is a pre-existing cultural mediator that a storybook can draw on, rather than a new metaphor that has to be invented from scratch. Framed narratively as, for instance, a flexible wooden house that bends during an earthquake set against a concrete building that can crack, this local knowledge becomes concrete and contextual for children, while also building pride in local heritage and reinforcing that traditional knowledge carries genuine, defensible relevance rather than being merely decorative (Natawidjaja, 2018).

This interpretation of local wisdom as a mediating device, rather than as decoration, is not merely a theoretical extrapolation from Vygotsky in this study; it is directly supported by disaster-education research elsewhere in Indonesia. Working with PAUD (early childhood) teachers in Gorontalo, Eraku et al. (2023) found that local-wisdom-based disaster mitigation content was considered urgent precisely because it gave teachers a culturally grounded entry point for a topic that otherwise felt abstract and externally imposed, echoing the pattern of unprompted disinterest in local wisdom, followed by strong endorsement once it was raised, observed among the Bengkulu teachers in this study. In a broader geography-education context, Mustofa and Handini (2020) found that disaster-education content built around local wisdom strengthened learners' preparedness character more effectively than content presenting safety procedures as generic, placeless instructions, because it connected the material to knowledge structures the community already trusted. Read together with Solfiah et al.'s (2020) finding that picture storybooks combining local cultural elements with safety information produced deeper understanding in children than storybooks built around generic themes, and Skene et al.'s (2022) finding that realistic, familiar settings support stronger story-based learning than fantastical ones, this body of evidence converges on the same conclusion from architecture, geography education, and early-childhood-literacy research independently: a Bengkulu-context storybook would not simply be a regional variant of existing disaster media, but a different pedagogical mechanism altogether. It would mediate disaster understanding through a cultural tool children already recognize from their own environment, rather than through an abstract or imported narrative frame. This distinction is what would give the proposed storybook both pedagogical relevance and scientific originality, and what would make the underlying approach, in principle, replicable in other disaster-prone regions with their own local wisdom a claim that this needs-

analysis study can motivate but cannot itself test, since doing so would require the prototype-development and validation stages that follow in the broader R&D project.

It is worth pausing on why local wisdom did not surface spontaneously in teachers' own accounts of what the storybook should contain, even though, once raised, this heritage seems obviously relevant. One plausible explanation, consistent with Setiawan et al.'s (2021) finding that Indonesian disaster-education media are typically produced by outside developers rather than by local educators, is that teachers have primarily encountered disaster-education content that already treats safety information as a set of universal procedures to be transmitted, separate from local culture, rather than as something a community's own architecture and history can also teach. If that pattern holds, then simply asking teachers what they want from a storybook, without prompting them toward their own local knowledge, risks reproducing the very generic-media pattern this study set out to move beyond. This suggests that the design phase of the broader R&D project should not rely solely on the same needs-elicitation method used here, but should actively include a structured local-knowledge inventory as a design input in its own right, following the participatory approach Eraku et al. (2023) recommend for translating local wisdom into classroom-usable disaster content.

3.5 Implications for Teacher Competence and Storybook Design

The finding that 73% of teachers struggle to develop instructional media independently signals a structural gap that a storybook alone cannot resolve; it needs to be accompanied by a teacher's guide that supports classroom use, rather than distributed as a standalone artifact and left to individual interpretation. Rahmawati and Hidayat (2023) similarly found that the effectiveness of picture storybooks in ECE settings depends heavily on the quality of teacher facilitation, particularly teachers' ability to ask open-ended questions that prompt children's critical thinking about safety actions rather than simply reading the story aloud. Seddighi et al. (2020) reached a compatible conclusion from a different angle, finding that disaster-education programs designed participatorily with local communities were more effective at building children's knowledge and preparedness than generic, top-down programs a finding that reinforces the case for involving Bengkulu teachers, parents, and community members directly in the storybook's subsequent development and validation stages, rather than treating them only as end users once the product is finished.

Two limitations of this needs-analysis stage should be acknowledged. First, because participants were purposively drawn from ECE institutions within Bengkulu City itself, the findings describe urban teachers' perceptions and may not generalize to rural districts within Bengkulu Province, where access to instructional resources and possibly also the salience of local architectural heritage in daily life may differ. Second, both the questionnaire and the interviews relied on teachers' self-reported competence and storybook use rather than on direct classroom observation, so the reported percentages should be read as teachers' own assessments rather than as independently verified behavioral measures. Neither limitation undermines the central finding of near-universal demand for a contextualized storybook, but both should inform how the subsequent design and validation stages of this R&D project are sampled and measured.

Taken together, the five findings above indicate that the needs-analysis stage of this R&D project has surfaced not only a demand for a product (a storybook) but also a demand for a process: a development pathway that treats Bengkulu's local wisdom as a legitimate cultural tool, embeds it consistently across setting, character, and mitigation-action content, and pairs the resulting storybook with facilitation support for teachers. This composite picture will directly inform the Design and Development stages of the broader ADDIE-based project.

CONCLUSION

This study reveals a clear gap between the need for earthquake-mitigation literacy education and the availability of contextually appropriate instructional media in ECE institutions in Bengkulu City. The key findings show that: (1) storybook use in ECE learning remains limited and dominated by generic themes; (2) only 13% of schools own an earthquake-mitigation storybook; (3) 73% of teachers struggle to develop instructional media independently, across content, pedagogical, and technical dimensions; and (4) all teachers (100%) expressed an urgent need for a Bengkulu-context picture storybook that is built consistently around local setting, characters, and mitigation actions. Bengkulu's geological character (the Sumatran Fault Zone), its earthquake-resistant architectural heritage (Rumah Bubungan Lima), and its cultural richness together provide a unique and meaningful foundation for such a storybook. Understood through the lens of cultural-tool mediation, a locally grounded medium would not only strengthen the connection between instructional content and children's real experience, but also contribute to preserving local wisdom and building children's cultural identity from an early age.

Building on these findings, the next stage of this R&D project should proceed to design, develop, and validate a prototype Bengkulu-context earthquake-mitigation picture storybook, involving teachers, parents, and the local community throughout its development rather than only at the point of dissemination. Because teachers' competence to use such a resource, not only its content, was identified as a central barrier, its development should be paired from the outset with a teacher's facilitation guide and with training on using the storybook as an interactive, participatory disaster-education medium. As a needs-analysis study, this research is necessarily limited to establishing the case for such a product; the storybook's actual effectiveness in building children's earthquake literacy remains to be tested in the subsequent development and evaluation stages. Future research following this needs analysis should also examine whether the cultural-tool mediation approach identified here using a region's own architectural and survivor heritage, rather than an imported narrative frame, to teach disaster concepts holds in other seismically active Indonesian regions with their own distinct local wisdom, which would help clarify whether Bengkulu's case represents a generalizable design principle or a context-specific solution.

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AUTHORS' NOTE

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