



Edutainment-Based Disaster Education Strategies from a Community Empowerment Perspective to Enhance Early Childhood Disaster Literacy

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Abstract

Disaster literacy should be introduced during early childhood to strengthen preparedness and reduce future disaster risks; however, conventional instructional approaches often fail to provide meaningful learning experiences for young children. This study aimed to examine the implementation of edutainment-based disaster education in enhancing disaster literacy among early childhood learners from a community empowerment perspective. A qualitative case study was conducted at the Banyumas Regional Disaster Management Agency (BPBD), Indonesia, involving two disaster education facilitators and fifteen early childhood learners selected through purposive sampling. Data were collected through semi-structured interviews, participatory observations, and documentation, and analyzed using thematic analysis involving open, axial, and selective coding. The findings indicate that integrating educational games, disaster simulations, songs, and visual media promotes active participation, strengthens children's understanding of disaster risks, and improves practical preparedness skills through experiential learning. The study further reveals that facilitators play a crucial role in creating participatory learning environments that support community awareness and collective responsibility for disaster preparedness. Nevertheless, limited instructional time and the diverse developmental characteristics of young learners remain important challenges for program implementation. This study contributes to disaster education literature by conceptualizing edutainment as an integrated pedagogical approach that links experiential learning with community empowerment, while providing practical guidance for developing child-centered and sustainable disaster education programs in disaster-prone communities.

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INTRODUCTION

Disasters have become one of the most persistent global challenges, affecting not only physical infrastructure but also social systems, educational continuity, and the long-term well-being of vulnerable populations. Children are consistently identified as one of the groups most exposed to disaster risks because their cognitive, emotional, and physical capacities to recognize hazards and respond appropriately are still developing (Masten, 2021; Sadeghloo & Mikhak, 2022; Spencer & Thompson, 2024). As climate-related disasters, geological hazards, and environmental degradation continue to increase in frequency and intensity, the need for disaster risk reduction has shifted from reactive emergency response toward preventive educational strategies that cultivate preparedness from an early age. International frameworks such as the Sendai Framework for Disaster Risk Reduction emphasize that disaster education should be integrated into formal and non-formal learning environments to strengthen community resilience across generations (Gavari-Starkie et al., 2021; Lunga et al., 2025). Despite this global recognition, disaster education remains unevenly implemented, particularly in learning environments designed for young children. Many educational initiatives continue to prioritize factual knowledge while overlooking the developmental characteristics that influence how children acquire, retain, and apply information (Bjorklund, 2022;

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Pradeep et al., 2024; Sana & Fenesi, 2025). Consequently, strengthening disaster literacy among early childhood learners has become an educational priority that requires innovative pedagogical approaches capable of transforming abstract concepts into meaningful learning experiences.

Indonesia represents a particularly important context for examining this issue because of its high exposure to earthquakes, volcanic eruptions, floods, landslides, and other natural hazards that frequently disrupt community life (Dartanto, 2022; Lessy et al., 2024). Although national policies increasingly recognize disaster education as an essential component of preparedness, its implementation within early childhood education remains inconsistent across regions and institutions (Fu & Zhang, 2024; Masten, 2021). Learning activities are often delivered through conventional teacher-centered instruction that emphasizes memorization rather than experiential engagement, limiting children's opportunities to develop practical preparedness skills. Such approaches frequently fail to accommodate the developmental needs of young learners, who naturally construct understanding through play, exploration, social interaction, and direct experience. As a result, many children may recognize different types of disasters without fully understanding how to respond appropriately when emergencies occur. This discrepancy between conceptual understanding and behavioral preparedness illustrates a significant weakness in existing educational practices. Considering Indonesia's recurrent disaster events and the vulnerability of young children, educational models that combine cognitive learning with authentic experiences are increasingly viewed as essential for developing sustainable disaster literacy (Suharti et al., 2025).

The limitations of current disaster education also raise broader concerns regarding the relationship between educational practice and community resilience (Mutch, 2023). Disaster preparedness cannot be established solely through the transmission of information because effective preparedness requires repeated practice, emotional engagement, collaborative participation, and opportunities to apply knowledge in realistic situations (Elvegård et al., 2024). Early childhood education therefore demands learning environments that are interactive, enjoyable, and closely connected with children's everyday experiences. Within this context, edutainment has attracted increasing scholarly attention because it integrates educational objectives with enjoyable learning activities capable of sustaining children's motivation and participation (Christopoulos & Mystakidis, 2023). Games, storytelling, simulations, songs, and visual media provide opportunities for children to experience disaster scenarios in ways that reduce anxiety while strengthening understanding and confidence (Papadopoulou et al., 2024). Beyond improving classroom engagement, such approaches also encourage collaboration among educators, families, and community institutions, thereby positioning disaster education as a shared social responsibility rather than an isolated instructional activity. These considerations indicate that strengthening disaster literacy requires pedagogical innovation embedded within broader community empowerment efforts, making the integration of edutainment and participatory disaster education a timely and important area for further investigation.

Recent scholarship has demonstrated growing interest in strengthening disaster education for young children through innovative and child-centered pedagogical approaches. Systematic reviews consistently report that experiential learning, play-based instruction, storytelling, educational games, and interactive digital media contribute positively to children's understanding of disaster risks while promoting emotional security during learning activities (Demir Yıldız, 2025; Pamaong & Shaw, 2025). In parallel, empirical studies have shown that contextual learning environments enable children to develop more meaningful connections between theoretical concepts and practical preparedness behaviours (Fantinelli et al., 2024; Huang & Chen, 2026). Technology-enhanced learning has also received increasing attention, with interactive multimedia and visual simulations reported to improve children's engagement and knowledge retention in disaster education programmes (Arikan et al., 2024). Likewise, gamification has emerged as an effective instructional strategy for introducing complex disaster concepts through enjoyable and developmentally appropriate activities that encourage active participation (Almufarreh, 2026; Krishnamoorthy et al., 2025). Other studies have emphasized that integrating disaster education into early childhood curricula contributes to the gradual development of risk awareness and preparedness from an early age (Rahma et al., 2025). Collectively, these studies indicate that disaster education is becoming progressively more learner-centred; however, the dominant emphasis

remains on evaluating instructional effectiveness rather than understanding how educational strategies operate within broader community contexts.

Although previous studies have generated valuable insights, several important limitations remain unresolved. Most existing research investigates individual instructional techniques, such as simulations, games, or digital media, as separate interventions rather than examining how these components interact as an integrated educational strategy (Kefalis et al., 2025; Staneviciene & Žekienė, 2025). Furthermore, many studies evaluate disaster education primarily through improvements in cognitive outcomes, while giving comparatively limited attention to behavioural preparedness, experiential learning processes, and the social mechanisms through which disaster literacy is developed (Guo et al., 2025; Kitagawa, 2024). Research also tends to position teachers or facilitators merely as knowledge transmitters instead of recognising their broader function as community actors capable of strengthening collective disaster awareness (Ross et al., 2024; Tabka, 2025). In addition, relatively few studies have explored disaster education from a community empowerment perspective, despite increasing recognition that resilience is constructed through collaborative participation among educational institutions, families, government agencies, and local communities. Another notable limitation concerns methodological orientation, as many investigations rely on outcome-based assessments while providing limited explanation of the pedagogical processes through which children internalise disaster knowledge into everyday preparedness behaviours. Consequently, current evidence offers only a partial understanding of how integrated educational experiences contribute to sustainable disaster literacy among young learners. These limitations indicate the need for research that moves beyond isolated instructional evaluation toward a more comprehensive understanding of disaster education as a participatory and socially embedded learning process.

Addressing these limitations requires a broader conceptual perspective that connects educational innovation with community empowerment in a single analytical framework. Rather than viewing edutainment merely as an entertaining instructional technique, this study conceptualises it as an integrated pedagogical strategy that combines experiential learning, participatory interaction, emotional engagement, and collaborative facilitation to strengthen children's disaster literacy. This perspective extends previous discussions by recognising that meaningful preparedness is developed not only through enjoyable classroom activities but also through interactions among facilitators, learners, and the surrounding community that collectively shape children's understanding of disaster risk. Accordingly, the principal research gap lies in the limited empirical evidence explaining how edutainment-based disaster education functions as a community empowerment strategy capable of fostering practical disaster literacy among early childhood learners (Linnell, 2021). Existing studies have largely examined either educational methods or community participation independently, leaving their interrelationship insufficiently explored (Clark, 2021). By investigating these dimensions simultaneously within the implementation of disaster education programmes conducted by the Regional Disaster Management Agency (BPBD) of Banyumas, this research seeks to provide a more comprehensive explanation of how participatory learning environments contribute to the development of children's preparedness (Debasu & Yitayew, 2024). The findings are expected to enrich current discussions on disaster pedagogy by integrating educational, social, and community perspectives into a unified framework, thereby establishing a stronger foundation for the subsequent presentation of the study's objectives and contributions.

Building upon the identified research gap, this study aims to analyse how edutainment-based disaster education is implemented to enhance disaster literacy among early childhood learners from a community empowerment perspective (Dushkova & Ivlieva, 2024; Seddighi et al., 2022). Specifically, the study examines how interactive learning activities including educational games, disaster simulations, songs, and visual media are organised and facilitated to create meaningful learning experiences that encourage children's active participation and preparedness. In addition, the research investigates the roles of disaster education facilitators in promoting participatory learning environments and strengthening collective awareness of disaster risk through community-based educational practices. Unlike previous studies that predominantly evaluate the effectiveness of individual instructional methods, this research focuses on the pedagogical processes through which disaster literacy is gradually internalised into children's knowledge, attitudes, and practical emergency response skills (Mubarak et al., 2025; Xerri et al., 2024). By employing a qualitative case

study approach within the disaster education programme conducted by the Regional Disaster Management Agency (BPBD) of Banyumas, the study seeks to generate an in-depth understanding of learning interactions within authentic educational settings. This contextual perspective enables a richer explanation of how educational innovation and community participation operate simultaneously to support disaster preparedness among young children (Masten, 2021; Palma et al., 2025). Consequently, the study provides empirical evidence that extends beyond measuring educational outcomes by explaining the mechanisms through which disaster literacy is constructed through participatory and experience-based learning.

The contributions of this study are expected to advance both theoretical understanding and educational practice in the field of disaster education. From a theoretical perspective, the findings contribute to the growing body of literature by positioning edutainment not merely as an instructional technique but as an integrated pedagogical framework that connects experiential learning, child-centred education, and community empowerment within disaster risk reduction. This integrated perspective offers a broader interpretation of disaster literacy as a multidimensional construct encompassing cognitive understanding, behavioural preparedness, social participation, and practical adaptive capacity. From a practical standpoint, the findings provide evidence-based recommendations for educators, disaster management agencies, early childhood institutions, and policymakers in designing disaster education programmes that are developmentally appropriate, participatory, and sustainable. The study also highlights the importance of strengthening collaboration among schools, families, local governments, and community organisations to ensure that disaster preparedness becomes a continuous educational process rather than an occasional intervention. Furthermore, the proposed perspective may serve as a reference for developing community-oriented disaster education models that are responsive to the developmental characteristics of young children while remaining adaptable to different local contexts. Ultimately, this study is expected to enrich contemporary discussions on early childhood disaster education by demonstrating that effective disaster literacy emerges through the integration of educational innovation, experiential engagement, and collective community participation, thereby supporting the development of more resilient and disaster-aware future generations.

METHOD

Research Design

This study employed a qualitative approach using a case study design to investigate the implementation of edutainment-based disaster education strategies in enhancing disaster literacy among early childhood learners from a community empowerment perspective. A qualitative case study was considered the most appropriate design because the study sought to explore educational processes, participants' experiences, and contextual interactions within a real-world setting rather than measuring causal relationships or testing predetermined hypotheses. The research focused on understanding how disaster education was designed, implemented, and experienced by both facilitators and young learners during educational activities conducted by the Banyumas Regional Disaster Management Agency (BPBD). This design enabled the researchers to examine the educational process holistically by considering the interrelationships among instructional strategies, children's participation, facilitator roles, and the surrounding social environment. Furthermore, the case study approach facilitated the integration of multiple sources of qualitative evidence, including interviews, observations, and documentation, thereby providing a comprehensive understanding of how disaster literacy was constructed through experiential learning. By emphasizing contextual interpretation rather than statistical generalization, the study generated rich empirical evidence concerning disaster education practices that may inform similar educational settings facing comparable disaster risks. To enhance methodological transparency and provide readers with a comprehensive overview of the research process, the entire procedure is summarized in Figure 1. The workflow illustrates the sequential stages undertaken throughout the investigation, beginning with the identification of the research problem and continuing through literature review, site selection, ethical preparation, participant recruitment, instrument development, data collection, thematic analysis, interpretation of findings, and conclusion development. Presenting the

methodology in a visual format enables readers to understand the logical progression of the study before examining each methodological component in greater detail.



Figure 1. Research Procedure of the Qualitative Case Study

As illustrated in Figure 1, the research procedure was conducted systematically through interconnected stages designed to ensure methodological rigor and analytical consistency. Each phase informed the subsequent stage, allowing the researchers to refine data collection continuously while maintaining alignment with the study objectives. The workflow also demonstrates the iterative nature of qualitative inquiry, in which data collection, verification, coding, and interpretation occurred simultaneously rather than as isolated procedures. Such an approach strengthened the credibility of the findings by allowing continuous comparison among emerging themes, empirical evidence, and theoretical perspectives throughout the research process.

Research Site and Period

The study was conducted at the Banyumas Regional Disaster Management Agency (Badan Penanggulangan Bencana Daerah/BPBD), Central Java, Indonesia, an institution that actively organizes disaster education programs for early childhood learners as part of its community-based disaster risk reduction initiatives. This research setting was selected purposively because it represents one of the local government agencies implementing disaster education through interactive and experience-based learning activities, making it highly relevant to the objectives of this study. Data collection was undertaken over approximately three months, allowing the researchers to become sufficiently familiar with the educational environment, observe repeated learning sessions, and develop a comprehensive understanding of the interactions occurring throughout the implementation of the edutainment program. Conducting prolonged engagement in the field also enabled the researchers to capture variations in instructional practices, participant responses, and contextual conditions, thereby contributing to a richer interpretation of the educational processes observed during the study.

Participants

The participants consisted of 17 individuals, including two disaster education facilitators from the Prevention and Preparedness Division of the Banyumas Regional Disaster Management Agency and fifteen early childhood learners who actively participated in the disaster education program. Participants were selected using purposive sampling, as this technique is widely employed in qualitative research to identify individuals capable of providing information relevant to the research objectives. The inclusion criteria for facilitators included direct involvement in planning and delivering disaster education activities, practical experience in community-based disaster preparedness programs, and willingness to participate voluntarily in the research. The participating children were selected based on their active involvement in the educational activities conducted during the observation period. Participant recruitment continued until data saturation was achieved, indicated by the recurrence of similar patterns and the absence of substantially new information emerging from additional observations and interviews. Consequently, the selected participants were

considered capable of providing comprehensive insights into the implementation of edutainment-based disaster education within the investigated setting.

Research Instruments

Data were collected using three complementary qualitative instruments, namely semi-structured interviews, participatory observation, and documentation. Semi-structured interviews were designed to obtain in-depth information regarding participants' experiences, perceptions, instructional practices, and reflections concerning the implementation of edutainment-based disaster education. The interview protocol consisted of several key domains, including the design of educational activities, instructional strategies employed during disaster education sessions, children's participation and responses, perceived educational effectiveness, community involvement, and challenges encountered during implementation. Participatory observation was conducted to examine directly the interactions between facilitators and learners, children's engagement during educational games and disaster simulations, communication patterns, and observable preparedness behaviors throughout the learning process. Meanwhile, documentation served as a complementary source of evidence by collecting photographs, activity reports, educational materials, and institutional documents related to the disaster education program. The integration of these three instruments enabled methodological triangulation while providing comprehensive empirical evidence from multiple perspectives, thereby strengthening the depth and richness of the qualitative data.

Instrument Trustworthiness

Because the researcher served as the primary research instrument, several strategies were implemented to enhance the trustworthiness of the study. Credibility was strengthened through prolonged engagement in the research setting, persistent observation of educational activities, and continuous interaction with participants throughout the fieldwork period. Source triangulation was employed by comparing information obtained from disaster education facilitators, observational findings, and supporting documentation, while method triangulation was achieved by integrating interviews, participatory observations, and documentary evidence. To ensure the accuracy of data interpretation, member checking was conducted by returning preliminary findings and thematic interpretations to the facilitators for confirmation and clarification. In addition, the researchers maintained reflective field notes throughout the investigation to document analytical decisions, emerging interpretations, and potential researcher biases during both data collection and analysis. Finally, confirmability was maintained by preserving interview transcripts, observation records, documentary evidence, coding records, and analytical memos, thereby establishing a transparent audit trail that enables the research process to be reviewed and replicated by future researchers.

Data Collection Procedures

Data collection was conducted through a systematic and iterative process over approximately three months, following the research workflow presented in Figure 1. Prior to the field investigation, the researchers obtained institutional permission from the Banyumas Regional Disaster Management Agency (BPBD), prepared the research instruments, and established communication with the disaster education facilitators responsible for the implementation of the educational program. Preliminary observations were subsequently undertaken to familiarize the researchers with the learning environment, educational activities, and participant characteristics while refining the observation focus and interview protocol. The primary data collection process integrated three complementary techniques to obtain comprehensive qualitative evidence. Semi-structured interviews were conducted individually with the two disaster education facilitators to explore their experiences in designing and implementing edutainment-based disaster education, their perceptions of children's participation, instructional challenges, and strategies for promoting disaster preparedness through community engagement. Each interview was audio-recorded with participants' consent and subsequently transcribed verbatim to preserve the authenticity of participants' narratives. In parallel, participatory observations were carried out throughout the educational sessions to examine facilitator-child interactions, children's behavioral responses, participation during educational games and disaster simulations, communication patterns, and observable preparedness practices within authentic learning situations. Documentary evidence,

including educational materials, photographs, institutional reports, activity schedules, and visual learning resources, was collected to complement and verify the information obtained from interviews and observations. Data collection followed an iterative process characteristic of qualitative inquiry, allowing preliminary findings from one technique to inform subsequent observations and interviews. Field notes were maintained continuously to document contextual information, emerging patterns, researchers' reflections, and analytical insights throughout the investigation. This iterative procedure facilitated continuous comparison among multiple sources of evidence, enabling the researchers to capture a comprehensive understanding of how edutainment strategies contributed to the development of disaster literacy among early childhood learners.

Data Analysis

The collected data were analyzed using thematic analysis integrated with the interactive analysis model proposed by Miles, Huberman, and Saldaña (2024). Data analysis began immediately after the initial field observations and continued throughout the research process, allowing data collection and analysis to proceed simultaneously in an iterative manner. Such an analytical strategy enabled the researchers to refine subsequent data collection activities based on emerging findings while maintaining close alignment with the study objectives. The first analytical stage involved data familiarization, during which interview transcripts, observation records, documentary evidence, and field notes were repeatedly reviewed to achieve a comprehensive understanding of the dataset. Following familiarization, open coding was conducted by systematically identifying meaningful units of information related to instructional practices, children's participation, facilitator roles, disaster literacy development, community empowerment, and implementation challenges. Each relevant segment of data was assigned descriptive codes representing participants' experiences and observed educational practices. The second stage consisted of axial coding, in which conceptually related codes were compared, refined, and organized into broader analytical categories by examining relationships, similarities, and differences among the coded data. This procedure enabled the identification of conceptual connections between educational strategies, children's learning experiences, facilitator practices, and contextual factors influencing disaster literacy development. During this stage, the researchers continuously compared emerging categories across interviews, observations, and documentary evidence to strengthen analytical consistency.

Subsequently, selective coding was undertaken to integrate the analytical categories into overarching themes representing the central phenomena observed throughout the study. Theme development involved identifying recurring patterns across multiple data sources while ensuring that each theme was supported by sufficient empirical evidence. Constant comparative analysis was employed throughout the coding process to examine similarities, differences, and relationships among participants' experiences and observational findings, thereby enhancing analytical depth and conceptual coherence. The final stage involved interpretation and conclusion drawing, during which the emergent themes were interpreted through the lenses of Experiential Learning Theory (Kolb, 1984) and the Community Empowerment perspective. Rather than describing findings in isolation, the interpretation connected empirical evidence with relevant theoretical perspectives and previous research to explain how edutainment-based disaster education facilitated the development of disaster literacy among early childhood learners. This analytical process enabled the researchers to generate contextually grounded explanations while contributing to broader discussions concerning participatory disaster education and community resilience.

Research Ethics

Ethical principles were carefully observed throughout every stage of the research to ensure the protection, dignity, and well-being of all participants, particularly because the study involved early childhood learners. Prior to data collection, formal permission was obtained from the Banyumas Regional Disaster Management Agency (BPBD) as the host institution responsible for implementing the disaster education program. Participation in the study was entirely voluntary, and informed consent was obtained from the disaster education facilitators before interviews and observations were conducted. For the participating children, all research activities were undertaken within the officially organized educational program under the supervision of facilitators and responsible adults, ensuring that the observations did not interfere with the children's normal learning experiences. Participant confidentiality was maintained through anonymization, with all

identifying information removed from interview transcripts, field notes, and research documentation. Personal identities were replaced with anonymous codes during data analysis and reporting to protect participants' privacy. Digital records, including interview recordings, transcripts, photographs, and observational data, were securely stored and used exclusively for academic purposes. Throughout the research process, the investigators also maintained reflexive awareness regarding their own assumptions, interpretations, and potential biases by documenting analytical decisions and reflective notes. These procedures contributed to the credibility, transparency, and ethical integrity of the study while ensuring that the findings accurately represented participants' experiences and perspectives.

RESULTS AND DISCUSSION

Results

The results of this study are presented to provide a comprehensive understanding of the implementation of edutainment strategies in improving early childhood disaster literacy. The research findings were obtained from an in-depth analysis of observation data, interview transcripts, and documentation collected during the research process. The data was systematically analyzed using thematic analysis techniques integrated with interactive analysis models, through the stages of open coding, axial coding, and selective coding to identify recurring patterns and meaningful relationships between data. The presentation was carried out thematically by integrating empirical data and conceptual analysis to provide a comprehensive understanding of the implementation of edutainment-based disaster education strategies. The findings obtained are not only described as observations, but also critically analyzed by linking them to relevant theories and previous research. Thus, this section aims to uncover how edutainment strategies are applied in practice, how early childhood responds and engages in the learning process, and how the approach contributes to the perspective of community empowerment to improve disaster literacy in a more meaningful way.

Implementation of Edutainment Strategy in Disaster Education

The findings of the study show that the implementation of edutainment strategies in early childhood disaster education is carried out through a structured and integrated approach, by combining various interactive experiential methods. The first strategy is carried out through the delivery of material using visual media in the form of animated videos that display the types of disasters and their handling steps in a simple and interesting way. The use of visual media aims to help children understand the concept of disaster concretely through visual stimuli that are in accordance with their developmental characteristics. The second strategy is implemented through the application of disaster simulations that are packaged in a fun way by integrating children's songs adapted to disaster materials. At this stage, the facilitator first introduces various tools used in disaster situations, such as protective helmets, standby bags, and simple evacuation equipment, so that the child has an initial understanding of its function and use. When integrating songs, children are not only invited to listen, but also follow movements and mitigation measures, such as protecting their heads with bags, taking shelter, and following evacuation routes. This process is carried out in stages, starting from giving examples by the facilitator, followed by direct practice by the child, to repetition through the accompaniment of songs that make it easier for children to memorize and understand the procedure applicatively. One of the facilitators said that "Children understand faster when they immediately practice the actions to take when an earthquake occurs," which shows the importance of concrete experience in the learning process.

The third strategy is continued with practical activities in the form of flying fox simulations as part of experiential learning. This activity aims to train children's courage, preparedness, and response in dealing with emergency situations more realistically. Through this activity, children not

only understand the concept of disaster theoretically, but also gain hands-on experience that strengthens confidence and adaptive ability in conditions that resemble emergency situations.

The integration of these methods reflects a shift from a passive learning approach to active and participatory learning. Children no longer only receive information, but are directly involved in the learning process through real experiences. The results of observations showed that children who participated in learning with the edutainment approach had a higher level of involvement and better ability to understand and practice disaster actions. These findings confirm that disaster education in early childhood needs to be designed in a systemic and integrated manner, by combining various learning methods that are appropriate to the characteristics of the child. Thus, the edutainment strategy not only functions as a learning method, but also as a comprehensive approach in building applicable and sustainable disaster literacy.

Improving Early Childhood Disaster Literacy

The results of the study show that the implementation of edutainment strategies has a significant impact on increasing early childhood disaster literacy. The disaster literacy in question does not only include cognitive understanding, but also includes aspects of attitudes and skills in dealing with emergency situations. From the observation results, the children showed improved ability to recognize the types of disasters and understand the basic actions that must be taken. In the simulation activity, the child was able to practice the simple steps taken by the child, such as protecting the head with a bag during an earthquake and following evacuation instructions in an orderly manner, showing that learning does not only stop at the level of knowledge, but has reached the stage of application in the form of real actions. In addition, children also show a high level of participation, characterized by the courage to advance in direct practice as well as the ability to share information with peers. This learning process is more effective because the mitigation measures are packaged through children's songs that are adapted to earthquake simulations, making it easier for children to memorize and practice spontaneous actions. Not only that, in simulation activities such as flying foxes, children look agile and enthusiastic to try without showing fear, which indicates the formation of confidence and preparedness in facing emergency situations. This shows that the edutainment approach is able to integrate cognitive, affective, and psychomotor aspects in one meaningful learning experience.

Edutainment as an Instrument of Community Empowerment

In the perspective of community empowerment, the edutainment strategy applied is not only oriented to developing the capacity of children as individuals, but also simultaneously involves facilitators as agents of social change in building collective awareness of disaster issues. Based on the results of the interview, the facilitator does not only carry out the function of delivering material, but also acts as a mediator and catalyst for learning that is able to create an educational interaction space, encourage active participation of children, and stimulate the involvement of the surrounding social environment, including peers and companions. The role of facilitators in this context becomes crucial because they not only transmit information, but also shape contextual, fun, and meaningful learning experiences through an edutainment approach. This approach allows the process of internalizing disaster preparedness values more effectively, because children not only understand concepts cognitively, but also experience them directly through simulations, educational games, and practice-based activities. Thus, learning becomes more applicable and oriented towards behavior formation, not just conceptual knowledge.

Further, this approach reflects the key principles of community empowerment that emphasize participatory processes, capacity building (capacity building), as well as strengthening individual critical awareness in dealing with social problems. Empowerment is no longer understood as a process top-down, but rather as a collaborative effort that involves the subject as an active actor

in the learning process. This is in line with (Ramadhan & Imran, 2022) which states that Community empowerment is a process of strengthening capacity that requires the active involvement of the community in understanding, identifying, and solving social problems faced. In this context, edutainment-based disaster education is a strategic instrument in building the foundation of community resilience (community resilience) from an early age. Through fun and participatory learning experiences, children not only gain knowledge about the types of disasters, but also develop practical skills, responsiveness, and preparedness in dealing with emergency situations. The long-term impact of this process is the formation of a generation that has risk awareness and adaptive capabilities to disasters, which ultimately contributes to strengthening the social resilience of communities in a sustainable manner.

Obstacles in Program Implementation

Although edutainment strategies applied in disaster education have shown significant effectiveness in increasing child engagement and understanding, the study also identified a number of structural and pedagogical barriers that limit its implementation optimization. One of the main obstacles is the limited time for the implementation of activities, which causes the process of delivering material cannot be carried out in depth, systematically, and repeatedly. The relatively short duration of activities has an impact on limited opportunities for children to strengthen understanding through repetition and habituation, which are actually key elements in early childhood learning. As a result, the process of internalizing disaster preparedness knowledge and skills tends to not reach an optimal level. In addition, the characteristics of early childhood development are also significant challenges in program implementation. Variations in concentration levels, cognitive abilities, and responses to learning stimuli cause gaps in material acceptance. Not all children are able to maintain focus for the same duration, so some children tend to be easily distracted and lose involvement in the learning process. This condition demands a more adaptive, flexible, and oriented pedagogical approach to the individual needs of children, including the use of repetition of materials, variety of activities, and reinforcement through direct experience.

Furthermore, time constraints also have an impact on the limited comprehensive learning evaluation process. Facilitators do not have enough space to conduct an in-depth continuous assessment of children's understanding and preparedness. In fact, continuous evaluation is needed to ensure that learning does not only stop at the cognitive aspect, but is also able to form practical attitudes and skills in dealing with disaster situations. These findings confirm that the implementation of edutainment strategies in disaster education cannot be separated from the importance of broader systemic support. More flexible time management, continuous integration of activities, and strengthening learning designs oriented to early childhood development characteristics are needed. Thus, the disaster education process is not only an incidental activity, but develops into a continuous learning practice and is able to form preparedness inherent in children's daily lives.

Discussion

The findings demonstrate that the implementation of edutainment-based disaster education extends beyond increasing children's enjoyment during learning activities, functioning instead as an integrated pedagogical strategy that strengthens disaster literacy through meaningful experiential engagement. Rather than relying on conventional teacher-centred instruction, the programme combined animated visual media, disaster simulations, songs, and practical activities into a coherent sequence that encouraged children to actively construct knowledge through direct participation. This finding suggests that disaster literacy among early childhood learners develops more effectively when abstract concepts are translated into concrete experiences aligned with children's developmental characteristics. Such an interpretation reinforces the view that preparedness is not

merely the acquisition of factual knowledge but a gradual process of transforming experience into practical understanding and adaptive behaviour. From a theoretical perspective, these findings strongly support Experiential Learning Theory (Kolb, 1984), which posits that knowledge is generated through the continuous transformation of concrete experiences into reflective understanding and subsequent action. The observed learning process illustrates that children acquired disaster-related competencies because they experienced, practised, and reflected upon disaster scenarios within authentic yet developmentally appropriate learning environments, thereby demonstrating that experiential engagement represents a fundamental mechanism underlying the formation of disaster literacy.

The present findings are consistent with a growing body of international literature advocating experiential and child-centred approaches in disaster education while simultaneously extending existing knowledge by demonstrating how multiple instructional components operate synergistically rather than independently. Previous studies have shown that simulations, storytelling, educational games, and interactive multimedia improve children's engagement and understanding of disaster risks (Arıkan et al., 2024; Pamaong & Shaw, 2025; Papadopoulou et al., 2024). Likewise, Fantinelli et al. (2024) argued that contextual learning environments enable learners to bridge theoretical concepts with authentic practice, whereas Xerri et al. (2024) reported that experiential activities significantly enhance children's emergency preparedness. However, most earlier investigations examined these instructional techniques as isolated interventions designed to improve specific educational outcomes. In contrast, this study demonstrates that educational games, visual media, songs, and disaster simulations become substantially more effective when implemented as complementary components within a unified edutainment framework. This integrated perspective therefore expands current pedagogical discussions by suggesting that instructional effectiveness emerges not only from individual learning activities but also from the coherent interaction among multiple experiential strategies that collectively reinforce children's cognitive, behavioural, and emotional engagement with disaster preparedness.

Another important interpretation concerns the multidimensional nature of disaster literacy revealed through the implementation of edutainment-based learning. The findings indicate that children's learning outcomes extended beyond recognising disaster types and emergency procedures to include observable behavioural preparedness, increased participation, self-confidence, and spontaneous responses during simulation activities. This evidence challenges the traditional assumption that disaster literacy should primarily be evaluated through cognitive achievement, instead supporting a broader conceptualisation encompassing knowledge, attitudes, behavioural competence, and adaptive capacity. Such an interpretation aligns with recent arguments that disaster preparedness should be understood as a holistic developmental process integrating cognitive, affective, and psychomotor domains rather than as a purely informational construct (Guo et al., 2025; Rahma et al., 2025). Moreover, these findings resonate with contemporary perspectives in developmental psychology, which emphasise that young children's learning is strengthened when educational experiences engage multiple sensory modalities and encourage active participation (Bjorklund, 2022; Sana & Fenesi, 2025). The integration of movement, music, visual representation, and realistic simulation appears to facilitate deeper internalisation of preparedness behaviours because children repeatedly connect abstract disaster concepts with meaningful physical experiences. Consequently, this study contributes conceptually by positioning disaster literacy as a multidimensional capability constructed through repeated experiential interaction rather than as a static body of knowledge acquired through classroom instruction alone.

A further significant finding concerns the role of edutainment in transforming disaster education into a participatory process that promotes community empowerment rather than functioning solely as classroom-based instruction. The results indicate that facilitators assumed

responsibilities extending well beyond knowledge transmission by acting as mediators, motivators, and coordinators who created meaningful interactions among children, learning activities, and the broader social environment. This finding implies that effective disaster literacy is not produced exclusively through individual learning but is socially constructed through collaborative educational experiences that encourage participation, communication, and shared responsibility. From the perspective of community empowerment, such interactions strengthen children's capacity to become active participants in disaster preparedness while simultaneously reinforcing collective awareness within the surrounding community. This interpretation supports empowerment theory, which argues that sustainable capacity building emerges through participatory engagement, shared decision-making, and continuous interaction among community members rather than through top-down dissemination of information (Dushkova & Ivlieva, 2024). Consequently, the present study expands the theoretical understanding of disaster education by demonstrating that edutainment serves as a mechanism for connecting experiential learning with broader processes of community resilience, thereby integrating educational innovation and social empowerment into a unified conceptual framework.

This interpretation is broadly consistent with recent international research emphasising the importance of collaborative approaches in disaster risk reduction while offering a more comprehensive explanation of the mechanisms through which participation influences children's preparedness. Mutch (2023) argued that schools contribute to community resilience by strengthening social capital and fostering cooperation among educational stakeholders, whereas Ross et al. (2024) highlighted the importance of social learning in transmitting disaster knowledge across communities. Similarly, Fu and Zhang (2024) reported that community-based disaster education programmes are more sustainable when educators, local institutions, and families actively collaborate throughout the learning process. However, these studies primarily focus on institutional collaboration or community participation without explicitly explaining how child-centred pedagogical strategies facilitate empowerment at the individual level. The present findings address this gap by illustrating that edutainment-based activities provide the practical context through which children actively experience preparedness, facilitators guide reflective learning, and community values are gradually internalised into everyday behaviour. Therefore, this study not only supports previous evidence regarding collaborative disaster education but also extends the literature by clarifying the pedagogical processes linking experiential participation with community empowerment in early childhood settings.

Another noteworthy contribution concerns the contextual significance of facilitator competence in determining the effectiveness of edutainment-based disaster education. Although educational media, simulations, and games constituted important instructional resources, the findings suggest that their effectiveness depended largely on facilitators' ability to adapt learning activities to children's developmental characteristics and maintain meaningful engagement throughout the educational process. This observation reinforces socio-constructivist perspectives suggesting that learning occurs most effectively when knowledgeable adults scaffold children's understanding through guided interaction, feedback, and contextual support. Recent curriculum research likewise indicates that disaster literacy programmes become substantially more effective when facilitators possess the pedagogical flexibility to adjust instructional strategies according to children's cognitive readiness, emotional responses, and learning preferences (Huang & Chen, 2026; Suharti et al., 2025). Nevertheless, the present study advances existing scholarship by demonstrating that facilitator competence encompasses not only instructional expertise but also the capacity to create emotionally secure, enjoyable, and socially interactive learning environments that encourage children to explore disaster scenarios without experiencing excessive anxiety. This finding therefore modifies prevailing discussions that often portray facilitators primarily as instructional agents,

suggesting instead that they function as community educators whose pedagogical decisions simultaneously influence children's cognitive development, emotional confidence, and collective preparedness. By positioning facilitators at the intersection of experiential learning and community empowerment, the study provides a broader conceptual perspective for understanding how sustainable disaster literacy can be cultivated through child-centred educational practices embedded within community-based disaster risk reduction programmes.

Despite the substantial educational benefits identified, the findings also reveal several structural and pedagogical constraints that may limit the long-term effectiveness of edutainment-based disaster education. Limited instructional time reduced opportunities for repeated practice, reflective discussion, and continuous reinforcement, all of which are essential for consolidating disaster preparedness among young learners. Furthermore, considerable variation in children's developmental characteristics, including differences in attention span, cognitive readiness, and responsiveness to learning stimuli, created uneven learning outcomes across participants. These findings suggest that the success of experiential disaster education depends not only on the quality of instructional strategies but also on the extent to which programme implementation accommodates developmental diversity and provides sufficient opportunities for repeated engagement. Within the framework of Experiential Learning Theory, learning is viewed as a cyclical process involving concrete experience, reflective observation, abstract conceptualisation, and active experimentation. Consequently, when instructional time is constrained, children may complete only part of this learning cycle, reducing opportunities to internalise preparedness behaviours through repeated experiential practice. This interpretation indicates that sustainable disaster literacy requires educational continuity rather than isolated intervention, reinforcing the importance of integrating disaster education into ongoing early childhood learning programmes instead of implementing it as occasional extracurricular activities.

The implementation challenges identified in this study are broadly consistent with previous international research while also highlighting contextual issues that remain underexplored in disaster education literature. Guo et al. (2025) noted that many disaster education programmes continue to emphasise short-term knowledge acquisition without establishing mechanisms for sustained behavioural change. Similarly, Seddighi et al. (2022) concluded that school-based disaster preparedness initiatives frequently encounter implementation barriers related to limited instructional resources, inadequate programme continuity, and insufficient integration into regular educational practice. More recent studies by Mubarak et al. (2025) and Rahma et al. (2025) further emphasised that repeated exposure and developmentally appropriate instructional adaptation are essential for maintaining children's preparedness over time. The present findings support these conclusions but provide additional insight by demonstrating that implementation challenges arise not only from institutional constraints but also from the developmental complexity of early childhood learners. Unlike older students, young children require frequent repetition, multimodal learning experiences, and emotionally supportive environments to retain and apply preparedness knowledge consistently. This contextual explanation helps clarify why educational innovations that prove effective in one setting may produce different outcomes elsewhere, suggesting that programme success depends on the interaction between pedagogical design, learner characteristics, institutional support, and local implementation conditions rather than on instructional methods alone.

Taken together, the findings position this study within the evolving global discourse on disaster education by demonstrating that disaster literacy is most effectively developed through the integration of experiential pedagogy and community empowerment rather than through isolated instructional interventions. While previous studies have generally examined educational games, simulations, digital media, or community participation as separate determinants of disaster

preparedness, this research proposes a more comprehensive conceptual perspective in which these elements operate as mutually reinforcing components of a single pedagogical system. Theoretically, the study extends Experiential Learning Theory by illustrating that the transformation of experience into preparedness is mediated not only by individual reflection but also by participatory interactions with facilitators and the broader community. At the same time, it broadens community empowerment perspectives by showing that meaningful empowerment begins during early childhood through educational experiences that cultivate agency, collaborative participation, and shared responsibility for disaster risk reduction. These contributions address the research gap identified in the introduction by explaining the pedagogical mechanisms linking child-centred learning with community resilience, an area that has received relatively limited empirical attention in recent international scholarship. From a practical standpoint, the findings suggest that policymakers, disaster management agencies, and early childhood education providers should move beyond short-term awareness campaigns toward institutionalising integrated, developmentally appropriate, and community-oriented disaster education programmes. Such an approach has the potential to strengthen not only children's immediate preparedness but also the long-term adaptive capacity of disaster-prone communities, thereby establishing a stronger foundation for sustainable disaster risk reduction across generations.

CONCLUSION

This study demonstrates that edutainment-based disaster education provides an effective pedagogical approach for strengthening disaster literacy among early childhood learners by integrating experiential learning, active participation, and community engagement within authentic educational settings. The findings reveal that educational games, disaster simulations, songs, and visual media not only enhance children's understanding of disaster risks but also foster practical preparedness skills, confidence, and appropriate emergency responses through meaningful learning experiences. Viewed from a community empowerment perspective, the active involvement of disaster education facilitators extends beyond instructional delivery by creating participatory learning environments that encourage collective awareness and shared responsibility for disaster preparedness. The study also highlights that the effectiveness of edutainment is influenced by contextual factors, particularly limited instructional time and the diverse developmental characteristics of young children, indicating the need for continuous and developmentally appropriate educational programs supported by multiple stakeholders. Theoretically, this research contributes to disaster education literature by conceptualizing edutainment as an integrated pedagogical framework that connects experiential learning with community empowerment to promote sustainable disaster literacy. Practically, the findings offer evidence-based guidance for educators, disaster management agencies, and policymakers in designing child-centered disaster education programs that are interactive, contextually relevant, and capable of fostering resilient communities from an early age. Future studies are encouraged to investigate the long-term effectiveness of this approach across diverse educational and socio-cultural contexts while exploring broader collaborations among schools, families, and local communities to strengthen disaster preparedness as a lifelong learning process.

AUTHOR CONTRIBUTIONS STATEMENT

Eva Tatia Fazriani Conceptualization, methodology, investigation, data curation, formal analysis, validation, visualization, writing original draft, and project administration. Agus Sriyanto Conceptualization, methodology, supervision, validation, formal analysis,

writing review and editing. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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