

## Community-Based Education to Strengthen Landslide Risk Awareness in Gunungsari Village, Batu City, East Java, Indonesia

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### Volume

7

### Issue

1

### Edition

May

### Page

143-152

### Year

2026

### Article History

Submission: 03-01-2026

Review: 07-01-2026

Accepted: 09-05-2026

### Keyword

Disaster Education;

Landslide;

Rural Resilience;

### How to cite

Putra, R. P., Dewi, V. A. K., Masruroh, H., Perwitasari, D. A., Pamungkas, D. H. B., Wahyudi, A., Fitriana, E., Rahma, M. J., Herwanto, M. T. & Masyitoh, F., I. Deffinika. (2026). Community-Based Education to Strengthen Landslide Risk Awareness in Gunungsari Village, Batu City, East Java, Indonesia. *Jurnal Pengabdian Masyarakat*, 7(1), 143-152.  
<https://doi.org/10.32815/jpm.v7i1.2899>

### Abstract

**Purpose:** This study aims to enhance local capacity for landslide mitigation in Gunungsari Village, Batu City, addressing limited community awareness and unsustainable land use in landslide-prone terrain.

**Method:** A participatory community-based education approach was implemented in July 2025, involving household visits to 50 residents across five hamlets, distribution of illustrated leaflets, and focus group discussions with hamlet leaders covering landslide triggers, early warning signs, and mitigation measures using locally-adapted visuals and language.

**Practical Applications:** The programme offers a replicable, low-cost disaster education model for landslide-prone rural areas to improve community preparedness and engagement.

**Conclusion:** Results demonstrated increased disaster literacy, confidence, and preparedness among residents, confirming that contextual, participatory education effectively strengthens sustainable rural disaster resilience.



144) Community-Based Education to Strengthen Landslide Risk Awareness in Gunungsari Village, Batu City, East Java, Indonesia, Putra, R. P., Dewi, V. A. K., Masruroh, H., Perwitasari, D. A., Pamungkas, D. H. B., Wahyudi, A., Fitriana, E., Rahma, M. J., & Herwanto, M. T., Masyitoh, F., Deffinika, I.

## Introduction

Landslides represent a recurrent and escalating hydro-meteorological threat across Indonesia's mountainous regions, where steep topography, intensifying rainfall extremes, and anthropogenic land-use modifications converge to accelerate slope instability (Alkaesi et al., 2021; Li et al., 2022). Within this environmental context, Gunungsari Village in Batu City, East Java, exemplifies a rural community navigating the intersection of ecological vulnerability and socioeconomic dependence on horticulture and nature-based tourism. Despite its agricultural productivity and cultural heritage, the settlement experiences frequent landslide incidents during monsoon periods, largely exacerbated by unregulated slope cultivation, deforestation, and inadequate soil conservation practices (Anisykurlillah, 2022; Wulandari, 2016). The core problem under examination lies in the persistent disconnect between regional hazard assessments and localized disaster preparedness, wherein fragmented early warning mechanisms and limited community literacy leave residents disproportionately exposed to preventable geological risks.

The selection of Gunungsari Village as the focal site for this engagement is justified by its representative status as a high-risk rural settlement where institutional disaster management frameworks remain underdeveloped relative to exposure levels. Regional vulnerability assessments indicate that over thirty percent of the surrounding Bumiaji Subdistrict exhibits high landslide susceptibility, yet mitigation efforts at the community level remain predominantly reactive rather than preventive (Noviari et al., 2023). Bridging the gap between macro-level disaster risk reduction policies and micro-level community implementation necessitates targeted, context-sensitive interventions that prioritize localized capacity building over externally imposed protocols. Consequently, this investigation narrows its scope to the design and deployment of a participatory community-based education programme, systematically evaluating how structured household outreach and institutional dialogue can translate scientific risk parameters into actionable, culturally resonant preparedness measures.

Contemporary scholarship on disaster preparedness increasingly advocates for the integration of technological early warning systems with grassroots risk communication; however, empirical evidence consistently demonstrates that technological interventions alone yield limited efficacy in rural contexts without complementary literacy development and behavioural adaptation (Sholeh & Mustopa, 2024; Suwarno et al., 2022). Existing studies emphasize the theoretical value of participatory disaster risk reduction frameworks, yet a notable gap persists in the systematic documentation of low-cost, culturally adapted educational models that effectively bridge geoscientific indicators with indigenous observational knowledge (Karnoto & Agung Purwanto, 2025). Furthermore, while community engagement is widely recognised as a cornerstone of resilience, few investigations critically assess how dual-tiered interventions combining direct household education with institutional focus group discussions can catalyse sustained behavioural change and policy integration. This study positions itself within this scholarly discourse by implementing and evaluating a dialogic educational intervention, thereby addressing the identified limitations by demonstrating how contextualised knowledge exchange can strengthen both individual preparedness and local governance capacity in landslide-prone rural settings.

The projected societal impact of this engagement centres on the establishment of a replicable disaster education framework that enhances community self-reliance, fosters the formalisation of local disaster response teams, and promotes the integration of risk mitigation strategies into village development planning. By aligning qualitative insights from focus group discussions with quantitative engagement metrics, including household visitation records, attendance logs, and pre-post knowledge uptake indicators, the study constructs an evidence-based foundation that validates the efficacy of participatory educational interventions. The forthcoming results will delineate how contextualised risk communication directly influences community confidence, preparedness behaviours, and institutional readiness, thereby offering

145) Community-Based Education to Strengthen Landslide Risk Awareness in Gunungsari Village, Batu City, East Java, Indonesia, Putra, R. P., Dewi, V. A. K., Masruroh, H., Perwitasari, D. A., Pamungkas, D. H. B., Wahyudi, A., Fitriana, E., Rahma, M. J., & Herwanto, M. T., Masyitoh, F., Deffinika, I.

actionable pathways for scaling similar initiatives across comparable highland regions. Ultimately, this manuscript outlines the methodological implementation, evaluates participatory outcomes, and discusses policy implications, providing a comprehensive reference for practitioners and policymakers seeking to advance sustainable, community-driven disaster resilience in vulnerable rural landscapes.

## Method

The community service were designed to improve community awareness and preparedness through participatory education and institutional engagement. The programme combined individual education strategies with collective forums to ensure both personal understanding and institutional readiness. Activities were implemented over the course of July 2025 and involved all five hamlets in Gunungsari Village. The target participants included local residents, community leaders, and representatives from institutional bodies such as hamlets heads and secretaries. Materials used in this community service included printed educational leaflets, presentation slides, and stationery. The leaflets were carefully designed during the preparation phase to include key information such as landslide triggers, risk factors, early warning signs, and concrete preventive measures. These contentts were written using simple, clear language to ensure easy comprehension by the general public. Visuals and concise explanations were prioritised to ensure accessibility for all education levels. Presentation tools included a portable projector used during the focus group discussion (FGD). Documentation instruments such as notebooks, digital cameras, and attendance lists were employed to record the number of participants and capture qualitative feedback. The implementation of the activities was carried out using the three methods, i.e. leaflet design, door-to-door outreach and leaflet distribution, and Focus Group Discussion (FGD).

## Leaflet Design

Prior to field implementation, the team developed a visual communication strategy tailored to the literacy levels and risk profiles of the residents of Gunungsari Village. The leaflet content was refined through internal reviews and focused on four key themes: triggers of landslides, contributing risk factors, early warning signs, and simple, practical preventive actions (Figure 1). The leaflets were written in Indonesian using simple and accessible language to accommodate varying literacy levels and ensure effective understanding among community members. The clarity and cultural relevance of the visual design played a crucial role in facilitating comprehension and engagement during the outreach activities.

Figure 1. Leaflet Design



Source: Private Documentation, 2025.

146) Community-Based Education to Strengthen Landslide Risk Awareness in Gunungsari Village, Batu City, East Java, Indonesia, Putra, R. P., Dewi, V. A. K., Masruroh, H., Perwitasari, D. A., Pamungkas, D. H. B., Wahyudi, A., Fitriana, E., Rahma, M. J., & Herwanto, M. T., Masyitoh, F., Deffinika, I.

### Door-to-Door Outreach and Leaflet Distribution

On July 2, 2025, the team visited 50 homes spread across the five hamlets of Brau, Brumbung, Jantur, Kapru, and Pagergunung. During each visit, the team distributed international leaflets and engaged in direct conversations with local residents to explain the leaflet content and provide practical guidance based on their household location and conditions. This method enabled two-way communication and allowed the team to assess residents' initial understanding and concerns regarding landslide risks.

### Focus Group Discussion (FGD)

FGD was held on July 16, 2025, at a village meeting hall and attended by hamlet leaders and secretaries. The presentation introduced the programme's goals and explained the materials distributed during the outreach phase. Following this, an FGD was conducted to identify existing gaps in disaster preparedness, particularly regarding the functionality and maintenance of early warning systems (EWS). The session also discussed the possibility of forming community-based disaster response groups and embedding preparedness initiatives into the village's long-term development planning. The FGD session was interactive, with active participation from the attendees, which enriched the discussion and brought in diverse local perspectives.

### Evaluation Design

Three evaluation benchmarks were developed to measure the success of the programme, i.e., timely implementation, community engagement, and knowledge uptake. The success of the implementation was determined by the ability of the team to carry out all planned activities on time and in accordance with the number of scheduled meetings. Effective coordination and cooperation between the implementers and community participants were essential to achieving this goal. The success from the participants' side was measured by their ability to understand and apply the knowledge individually, particularly in recognising early signs of landslides and applying simple preventive actions at home. Enthusiasm for further involvement or community-based initiatives was also taken as a positive sign. The facilitators were evaluated on their ability to clearly communicate material, offer relevant guidance, and assist participants facing challenges in understanding or applying the information. Additional indicators included the consistency of facilitator attendance and the quality of interaction with local stakeholders during implementation.

This integrated methodological approach ensured not only the effective delivery of disaster knowledge but also created opportunities for adaptation. It allowed local stakeholders to develop a stronger sense of responsibility and ownership over their risk reduction efforts. The process facilitated meaningful participation, fostered mutual learning, and laid the groundwork for sustained community resilience initiatives. Ultimately, this approach highlights the value of co-produced knowledge and shared commitment in addressing disaster vulnerabilities in rural areas.

*Table 1.* Participant Distribution and Engagement Metrics Across Gunungsari Village Hamlets

| No.   | Hamlet      | Household visited |
|-------|-------------|-------------------|
| 1     | Brau        | 10                |
| 2     | Brumbung    | 10                |
| 3     | Pagergunung | 10                |
| 4     | Jantur      | 10                |
| 5     | Kapru       | 10                |
| Total |             | 50                |

Source: Author's Work, 2025.

147) Community-Based Education to Strengthen Landslide Risk Awareness in Gunungsari Village, Batu City, East Java, Indonesia, Putra, R. P., Dewi, V. A. K., Masruroh, H., Perwitasari, D. A., Pamungkas, D. H. B., Wahyudi, A., Fitriana, E., Rahma, M. J., & Herwanto, M. T., Masyitoh, F., Deffinika, I.

## Result

The community-based landslide risk education programme was systematically implemented in Gunungsari Village, Batu City, East Java, across a coordinated operational window in July 2025. Situated within the geologically susceptible Bumiaji Subdistrict, the programme targeted adult residents and local institutional representatives across five administrative hamlets: Brau, Brumbung, Jantur, Kapru, and Pagergunung. Participant selection prioritized permanent households residing within documented landslide-prone zones, with engagement facilitated through prior coordination with hamlet heads and local community leaders. The intervention sequence commenced with door-to-door household outreach on July 2, 2025, followed by an institutional Focus Group Discussion (FGD) on July 16, 2025. Logistical arrangements included the deployment of trained facilitator teams, pre-validated educational materials, and structured scheduling to ensure comprehensive geographical coverage and seamless stakeholder coordination throughout the implementation phases.

Figure 2. Distribution of the leaflets to the community in Gunungsari Village



Source: Private Documentation, 2025.

Programme execution generated quantifiable service delivery metrics that reflect comprehensive operational reach and efficient resource utilization. Direct outreach activities encompassed 50 completed household visits, with exactly ten residences engaged in each of the five hamlets, achieving a 100% completion rate against the targeted sample frame. Accompanying the visits, 50 contextually adapted illustrated leaflets were distributed and reviewed on-site with residents. The institutional engagement phase consisted of one structured FGD session attended by 15 hamlet leaders, secretaries, and village representatives, totaling approximately four hours of facilitated dialogue. Direct service provision encompassed an estimated 40 hours of field facilitation, material distribution, and interactive knowledge transfer. These metrics demonstrate effective logistical coordination, optimal facilitator deployment, and full attainment of the programme's planned delivery targets.

148) Community-Based Education to Strengthen Landslide Risk Awareness in Gunungsari Village, Batu City, East Java, Indonesia, Putra, R. P., Dewi, V. A. K., Masruroh, H., Perwitasari, D. A., Pamungkas, D. H. B., Wahyudi, A., Fitriana, E., Rahma, M. J., & Herwanto, M. T., Masyitoh, F., Deffinika, I.

The intervention yielded measurable improvements in community disaster literacy, risk recognition, and institutional preparedness awareness. Observational records and field documentation indicated a marked increase in residents' ability to identify geological early warning indicators, such as slope cracking, abnormal water drainage, and soil displacement. Attendance logs and engagement trackers confirmed consistent participation across all hamlets, with verbal feedback and structured questioning during visits revealing a transition from passive hazard awareness to actionable preparedness planning. Supporting evidence is further corroborated by photographic documentation of leaflet distribution (Figure 2), the institutional FGD proceedings (Figure 3), and interactive participant engagement. Qualitative feedback collected during the FGD highlighted the community's recognition of operational gaps in existing early warning systems and their expressed readiness to establish localized disaster response teams, thereby validating the programme's impact on both individual knowledge acquisition and collective institutional readiness.

*Figure 3. Implementation of FGD in Gunungsari Village*



Source: Private Documentation, 2025.

Analytical synthesis of the collected data indicates that the participatory, multi-tiered delivery model effectively aligned with the programme's core objectives of enhancing household-level disaster literacy and stimulating institutional risk management dialogue. The consistent engagement rates across all five hamlets, coupled with heightened discussion depth in the high-risk Brau area, demonstrate that geographically differentiated outreach strategies successfully accommodated varying exposure levels while maintaining village-wide coverage. The integration of scientific risk indicators with indigenous observational knowledge facilitated contextually relevant understanding, reducing informational asymmetry and fostering collaborative problem identification. These findings substantiate the practical effectiveness of low-cost, community-embedded educational interventions in rural highland settings. While the documented outcomes reflect immediate post-intervention gains rather than longitudinal behavioral tracking, the established engagement metrics and institutional feedback provide a robust empirical foundation for scaling similar participatory disaster education frameworks across comparable landslide-prone regions.

## **Discussion**

During the outreach, residents demonstrated a genuine interest in learning about landslide-related risks. Many conveyed that prior to the programme, they had not received detailed or structured information about the signs of impending landslides or the steps to mitigate risk. The direct and personal nature of the visits facilitated more effective communication than traditional one-way methods, allowing for clarification of doubts and context-specific discussions. In Brau, residents shared their anxieties about terrain cracks and shifting soils near farming paths, while in Brumbung and Pagergunung, agricultural land mismanagement was often cited as a contributing factor to erosion and slope instability. Participants in the FGD emphasised the need to establish community-based disaster

149) Community-Based Education to Strengthen Landslide Risk Awareness in Gunungsari Village, Batu City, East Java, Indonesia, Putra, R. P., Dewi, V. A. K., Masruroh, H., Perwitasari, D. A., Pamungkas, D. H. B., Wahyudi, A., Fitriana, E., Rahma, M. J., & Herwanto, M. T., Masyitoh, F., Deffinika, I.

response teams that could be trained and activated when needed. They recognised that preparedness cannot solely depend on external actors or government agencies, and must be embedded in the routine functions of the village. There was a strong recommendation for the integration of disaster education in local school curricula, reflecting an understanding that long-term risk awareness should begin at the family and educational level. These discussions highlighted the village's readiness to embrace a more systematic and locally grounded approach to disaster risk reduction.

We observed that the discussions were marked by openness, critical thinking, and the willingness to explore both problems and possible solutions. Many community leaders recalled specific environmental changes, such as sudden slope failures or changes in water drainage patterns, that preceded previous incidents. These experiences aligned with established scientific parameters for identifying geohazards, suggesting that the community holds valuable knowledge that could be formalised into a localised early warning model. Such knowledge-sharing could inform both policy and practice, encouraging hybrid systems that combine empirical science with indigenous observations. Participation throughout the outreach and FGD activities was consistent and enthusiastic (Figure 4). Photo documentation and attendance logs showed full representation from all five hamlets. In addition to verbal feedback, residents and local leaders provided concrete suggestions for improving disaster response, including routine drills, hazard mapping, and training for youth volunteers. These contributions are now being compiled for future planning and implementation, potentially forming the basis of more institutionalised disaster education within the village framework.

*Figure 4. The FGD Proceeded in an Interactive Manner*



Source: Private Documentation, 2025.

Another notable outcome was the reinforcement of trust and collaboration between the academic team and the local community. By emphasising shared learning and mutual respect, the programme created a two-way communication platform that validated local voices and built confidence in future cooperation. The academic facilitators adopted a participatory stance, positioning themselves as collaborators rather than external experts. This relational strategy significantly improved the flow of dialogue and reduced hesitation among participants to raise critical issues or ask questions. In sum, the programme successfully improved awareness at the household level while prompting institutional discussions that may lead to long-term changes in disaster preparedness. Residents gained the capacity to identify early warning signs and act accordingly, while village leaders began considering the integration of

150) Community-Based Education to Strengthen Landslide Risk Awareness in Gunungsari Village, Batu City, East Java, Indonesia, Putra, R. P., Dewi, V. A. K., Masruroh, H., Perwitasari, D. A., Pamungkas, D. H. B., Wahyudi, A., Fitriana, E., Rahma, M. J., & Herwanto, M. T., Masyitoh, F., Deffinika, I.

disaster response protocols into formal village development strategies. Although these outcomes are preliminary, they illustrate how well-designed educational interventions, combined with collaborative governance, can initiate meaningful community-based risk management practices.

The door-to-door method proved particularly effective in fostering meaningful dialogue. Unlike top-down dissemination strategies, this approach allowed residents to engage in personal, immediate exchanges with facilitators. In many cases, this interaction prompted residents to recount their own observations and concerns, which were then discussed in light of scientific knowledge. This reciprocal process not only strengthened the community's understanding but also helped facilitators to tailor the message to better suit the context of each hamlet. The adaptability and responsiveness of this method are crucial for improving by-in and sustainability. Differentiated strategies across the five hamlets acknowledged the geographic and socio-cultural diversity within Gunungsari Village. The programme's sensitivity to local variation was especially important in Brau, which faced more immediate geological risks compared to other hamlets. This location-specific planning allowed for more intensive outreach where needed, while still maintaining village-wide coverage. Such geographic targeting enhances the efficiency and effectiveness of community-based disaster risk reduction efforts.

The FGD further reinforced the importance of shared problem analysis. By providing a safe and constructive space, the FGD encouraged honest assessments of institutional readiness and resource limitations. Participants' recognition of the limited operational capacity of current EWS tools revealed systemic issues, such as the lack of technical maintenance and absence of user training. These structural barriers must be addressed if disaster preparedness is to evolve from reactive measures to proactive systems. Recommendations from the FGD included developing technical manuals, setting up community-based maintenance units, and establishing partnerships with academic institutions for regular evaluation.

Participants' suggestions to form local disaster response teams demonstrate an encouraging shift in perspective, from dependency on external aid to self-organised resilience mechanisms. This evolving mindset is essential for fostering autonomy and adaptability, particularly in rural areas that may not always receive immediate government assistance during emergencies. The prospect of involving young people in these teams, along with embedding disaster topics in local school curricula, illustrates a multigeneration approach that could yield long-lasting behavioural and institutional changes.

Another key insight emerged from the blending of formal scientific knowledge with indigenous experience. Many participants described environmental signals that had previously preceded landslide events, some of which closely matched formal risk indicators. This pattern echoes findings from other rural communities in Central Java, where local wisdom and long-standing land management practices have long supported collective mitigation against environmental hazards (Suwarno *et al.*, 2022). By recognising and incorporating such local insights into official educational content, the programme not only increased relevance but also empowered residents as co-creators of risk knowledge. This integration of scientific and indigenous perspectives creates a more comprehensive and culturally grounded approach to disaster mitigation (Karnoto *et al.*, 2024), particularly in rural settings where technological monitoring tools may be limited or unavailable.

The documentation and evaluation phase served not only to capture the progress of the initiative but also to encourage reflexive learning among both organisers and participants. Photos, testimonials, and attendance records provided empirical evidence of engagement, while feedback helped identify gaps for improvement. This iterative process exemplifies how community programmes can maintain accountability and improve over time through grounded and systematic reflection. From a broader perspective, the integrated nature of the programme offers a viable reference model for other disaster-prone rural areas. The combined use of outreach, institutional dialogue, and participatory learning created a holistic intervention that addressed both behavioural and systemic aspects of disaster preparedness. Importantly, the

151) Community-Based Education to Strengthen Landslide Risk Awareness in Gunungsari Village, Batu City, East Java, Indonesia, Putra, R. P., Dewi, V. A. K., Masruroh, H., Perwitasari, D. A., Pamungkas, D. H. B., Wahyudi, A., Fitriana, E., Rahma, M. J., & Herwanto, M. T., Masyitoh, F., Deffinika, I.

approach was developed and implemented with limited resources, showcasing that significant impact can still be achieved through strategic design and strong community relationships.

The discussion also points to the importance of continuity. While the programme succeeded in raising awareness, maintaining preparedness requires regular engagement (Sarjito, 2023). Recommendations for the next phase include formal training modules, simulation exercises, and policy integration at the village level. These steps are essential for moving from awareness to institutionalisation and ensuring that disaster education becomes an embedded part of daily life and governance structures. The collaborative relationship between the university team and Gunungsari residents proved foundational to the programme's achievements. By fostering mutual trust, encouraging open dialogue, and validating local expertise, the initiative established a strong platform for future community resilience efforts. The approach demonstrates that even in modest, resource-constrained settings, educational interventions, when thoughtfully designed and locally embedded, can serve as powerful tools for enhancing disaster preparedness and fostering long-term social change.

## **Conclusion**

The implementation of community-based disaster education in Gunungsari Village significantly enhanced residents' awareness of landslide risks and encouraged more active participation in mitigation efforts. Through direct household outreach and structured focus group discussion, the programme successfully facilitated two-way communication, allowing local experiences and observations to inform risk understanding. This approach not only improved individual knowledge but also highlighted institutional gaps, particularly in the operation and maintenance of early warning systems. The integration of scientific information with local wisdom proved effective in building trust, relevance, and long-term community resilience. To strengthen and sustain disaster preparedness in Gunungsari Village, disaster education should be integrated into formal village plans and school curricula. Establishing and training community-based response teams will improve local capacity during emergencies, while the maintenance and equitable distribution of early warning systems must be ensured. Regular disaster drills involving residents and local institutions are essential to build coordination and readiness. Finally, future education efforts should continue to combine scientific knowledge with local wisdom to keep risk communication contextually relevant and community-driven.

## **Acknowledgements**

The authors would like to express their sincere gratitude to Universitas Negeri Malang for funding this community service programme through the 2025 Internal Non-PNBP Grant, under contract number 24.2.232/UN32.14.1/LT/2025. This support was instrumental in enabling the implementation of disaster education activities in Gunungsari Village.

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