

Landslide Disaster Mitigation Education in Primary School Children

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ABSTRACT

Landslides often occur in highland areas. This disaster cause casualties, including children. Children are vulnerable to become victims of disasters. This research has the main purpose to find out children's knowledge about landslides and landslide mitigation as well as possible preventive measures that can do to prevent the landslide happen. The type of research is descriptive qualitative that used questionnaire method. The research wa held at SDN Cipayung 07, sample consist of fifth and sixth grade children. The level of knowledge about landslides and landslide mitigation was categorized into low, moderate, and high. The research was found out that 27 respondents(45%) are have high knowledge about landslide, 18 respondents (30%) are moderate, and 15 respondents (25%) have low knowledge about landslide. At the same time, 19 respondents (31.67%) have high knowledge about landslide mitigation, 25 respondents (41.67%) are moderate, and 16 respondents (26.67%) have low knowledge about landslide mitigation. Landslide prevention can be done by use gabion to hold the soil, close the land cracks with solid soil, reduce the thickness of the soil, plant the lands with the suitable plants, put the stones on the path, and make a good drainage channels on the land.

KEYWORDS

Education;
awareness;
student



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1. Introduction

Landslides are displacement downward movement of soil and rockslopes [1]–[5]. Frequent landslides this happens because of high rainfall in a region [6]. Landslides are also common occurs in the highlands. Region Puncak Bogor is one of the areas that vulnerable to landslides. Throughout every year the Puncak area is never separated from the threat of landslides [3]. Region It has hilly land contours and also steep [7]. Lots of development occur causing a reduction in land and trees that absorb water. Thing this is what causes it to happen so often the landslide disaster that caused it many victims. Landslide disaster can causing fatalities including children [8]. Children are vulnerable to become victims of disasters [9]. Thing this can happen due to lack of knowledge children about landslides. Children's vulnerability to disasters is triggered by factors of limited understanding of risks, so there are none disaster preparedness. Indonesia's disaster preparedness still weak, it is visible from large number of victims and property of each disaster incident [10]. This shows its importance disaster knowledge and mitigation disaster risk early on to deliver understanding and direction steps what to do when something happens threats to reduce disaster risk.

Several studies on disaster erosion that have been studied by previous researchers are used as a reference. Integrating the SLIDE model in CAESAR-Lisflood: Modeling the mechanism of the 'rainfall-landslide-flood' disaster chain under the evolution of landscapes in mountainous areas was researched by Li [11]. Social vulnerability assessment of landslides based on the enhanced TOPSIS method: A case study of eleven small towns in China researched by Xiao [12]. Disaster risk governance for district-level landslide risk management in Bangladesh was investigated by Alam [13]. Experience of landslide survivors from Kodagu District, India: The need for micro-disaster management planning at the village/kelurahan level that involves the community was researched by Matpady [14]. The TPDP-MPM-based approach to understand the mechanism of the evolution of the disaster chain due to landslides was investigated by Du [15]. Landslide vulnerability assessment using the weight of evidence model and cluster analysis along a highway in the Hubei section of the Three Gorges Reservoir Area was investigated by Chen [16].

Insights gained in geo-hydrological disaster management 25 years after the 1998 landslide disaster in southern Italy was investigated by Esposito [17]. The role of social capital in the evolution and transfer of local knowledge in rural community networks facing landslides in Sri Lanka was studied by Dasanayaka [18]. An extension of the two-phase multipoint material point method to simulate a landslide-induced spike process was investigated by Du [19]. Flash floods and landslides in the city of Recife, Northeast Brazil after heavy rains on 25–28 May 2022: Causes, impacts, and disaster preparedness researched by Marengo [20]. The effects of seasonality and disasters on food diversity and food insecurity coping strategies among landslide-prone groups were investigated by Nahalomo [21]. A landslide mitigation strategy in southeastern Bangladesh: Lessons learned from institutional responses was researched by Sultana [22].

Revealing the 70 year old degradation of permafrost that led to the disaster in the Arctic, the 1952 Niortuut tsunami-landslide in West Greenland is being studied by Svennevig [23]. Avalanche risk prediction using the GBRT algorithm: The application of artificial intelligence in energy mining disaster prevention was investigated by Jiang [24]. A unique failure model for the landslide caused by the Wenchuan earthquake in the Liujiawan area, Qingchuan County, China was investigated by Luo [25]. Natech accident reduction scenario based on dynamic Bayesian network: A case study of a landslide accident in a liquor storage tank area in Guizhou Province, China was investigated by Hao [26]. Evaluating the relationship between land use change and the 2018 landslide disaster in Kerala, India was investigated by Hao [27]. Mental well-being after landslides and displacement in Indonesia was investigated by Burrows [28].

Spatial relationship between landslides and land use activities in the Langat watershed: A case study researched by Selamat [29]. Natural disasters and building performance: Evidence from the 2011 Rio de Janeiro Landslide investigated by Alves [30]. The geological hazard assessment of line slides based on remote sensing data and GIS was investigated by Tan [31]. The development of a Geoenvironmental GIS to investigate Landslides and Slope Instability along the Central Himalayan Frontal zone was investigated by Rawat [32]. Evaluation of landslide geological hazard sensitivity based on Multi-source Remote Sensing Data was investigated by Wang [33]. A survey on the resilience of households to landslides in the Murree hills of Pakistan was undertaken by Qasim [34].

The coordinated evolution and mechanism characteristics of the tunnel-slide system under rainfall conditions were investigated by Wei [35]. The mechanism of rainfall-induced landslides in Yunnan Province using multiscale spatiotemporal analysis and remote sensing interpretation was investigated by He [36]. Municipal scale landslide risk index map for Costa Rica commissioned by Quesada-Román [37]. Monitoring the horizontal displacement of the landslide surface based on image recognition technology and computer vision was investigated by Xin [38]. An interpretation model for high-resolution remote sensing imagery earthquakes and landslides based on bag of visual word was studied by Bai [39]. Rapidly assessing the susceptibility of landslides to earthquakes on a global scale using random forests was investigated by He [40].

Disaster mitigation is an effort to reduce risks and impacts caused by disasters on society, through physical development awareness and capacity building in dealing with disasters. The disaster mitigation researched by previous researchers has become a reference for this community service. Institutional challenges in reducing disaster risk in a remote town in the Hindukush-Karakorum-Himalayan (HKH) region, Pakistan was investigated by Shah [41]. Reconstruction of disaster education: The role of customary disaster mitigation for learning in Indonesian elementary schools was researched by Suarmika [42]. Examining local institutional networks for sustainable disaster management: Empirical evidence from the Southwest coastal region of Bangladesh researched by Mohibbullah [43]. Model of continuous disaster risk reduction training for nurses: A descriptive qualitative approach researched by Hamid [44]. Modeling flood disaster mitigation through community participation based on land conversion and disaster resilience was researched by Nugraheni [45]. Mitigation knowledge and preparedness attitudes of health vocational students in Jakarta in dealing with earthquake disasters were studied by Maizar [46].

Disaster mortality and the Sendai Framework Target A: Insights from Zimbabwe investigated by Mavhura [47]. The seismic resistance of internet data center buildings with various disaster mitigation techniques was investigated by Shang [48]. Disaster mitigation and its strategies in a global context – a state of the art researched by Gireesh Kumar [49]. Effects of social environment and psychological

cognition on individual behavioral intentions to reduce disaster risk in geological disaster-prone areas: Application of social cognitive theory investigated by Cai [50]. Cross-sectoral preparedness and mitigation for network typhoon disasters with cascading effects was investigated by Hu [51]. Fifteen Years of the 2004 Indian Ocean Tsunami in Aceh-Indonesia: Mitigation, Preparedness and Challenges to the Long-Term Disaster Recovery Process researched by Syamsidik [52].

2011 Thailand Great Flood Disaster Review: Could it have been mitigated by a different dam operation based on better weather forecasts? studied by Loc [53] Evaluating the effectiveness of watershed management using agricultural land for ecosystem-based disaster risk reduction was studied by Osawa [54]. Factors influencing intention to prepare for “big” earthquake mitigation in the Philippines: Integrating protective motivation theory and extended theory of planned behavior was investigated by Ong [55]. Developing and understanding typhoon cascade effect scenarios in large coastal cities from a systems perspective for disaster risk reduction: Case study of shenzhen, China researched by Tang [56]. Blood supply interventions during disasters: Efficiency measures and strategies to mitigate volatility investigated by Chua [1]. Flood hazard zoning and suitability mapping of flood shelters for disaster risk mitigation in Bangladesh using geospatial technology was investigated by Uddin [57].

Incorporating social innovation in the elaboration of disaster risk mitigation policies was researched by Trejo-Rangel [58]. Integrated System Dynamics Model for Closed Loop Supply Chain under disaster impact: Cases of COVID-19 researched by Katsoras [59]. Mitigation of losses due to infrastructure disasters through asset management practices in the Middle East and North Africa region was researched by Mastroianni [60]. Toward disaster risk mitigation in large-scale school intervention programs researched by Fernández [61]. Geogrid reinforced brick building for earthquake disaster mitigation was investigated by Behera [62]. Mitigation of trafficking in migrants and children through disaster risk reduction: Insights from the Thai floods researched by Stoklosa [63].

The Passivity-Responsive continuum in disaster preparedness and mitigation processes: A synthesized theory researched by Gallego [64]. An assessment of structural measures for hydrometeorological disaster risk reduction in Sri Lanka was investigated by Ginige [65]. Smoothing the hierarchical angle: Integrating shared leadership to mitigate maritime disasters was researched by Casareale [66]. Optimizing the implementation of school development plans in flood disaster mitigation policies in tropical rain forests (Case study at SMP Negeri 5 Samarinda) was researched by Hasbi [67]. Disaster risk management system in Vietnam: progress and challenges researched by Lan [68]. Complexity of resilience capacity: Household capital and resilience outcomes in disaster cycles in informal settlements was investigated by Gaisie [69]. Mitigation activities can be in the form of: arrangement of space and buildings, development infrastructure, and delivery of education, counseling, as well as training. Cipayung State Elementary School 07 (SDN Cipayung 07) is one of them elementary school located in Cipayung Datar, Megamendung, Bogor. The heavy rain happened has caused it to happen landslides on the cliffs around the area. The landslide caused the victims to die as a result of being buried in the ground. This research is done to know the insights of school children. Basic information about landslides and landslide mitigation disasters as well as efforts that can be taken to prevent disasters from occurring landslides. The results of this study are expected to be useful for all parties associated with improving mitigation before, after and during the Avalanche land disaster.

2. Method

Population, Sample and Collection Technique Research Sample the research population comes from all grade 5 and 6 students of SDN Cipayung 07 who still enrolled as a student at the time the study was conducted namely 68 students. The amount the sample used in the study namely 60 students, calculated from the Slovin formula [70]–[79]. Sampling is done with simple random sampling technique.

$$n = \frac{N}{1+Ne^2} \quad (1)$$

Information:

n : The minimum number of samples

N : Population

e : Fault tolerance

Data Collection and Analysis

Questionnaire method used for know the insights of elementary school students about landslides and disasters mitigation. The questionnaire contains questions that will be answered by respondents. Closed questionnaire type by giving two alternative answers (yes and no). Points are obtained then arranged based on available categories. Level understanding of knowledge and mitigation Landslides are categorized into low, medium, and high as in table 1

Table 1. Knowledge level categories

No	Category	Range Points
1	Low	$X \leq M - 0,5 SD$
2	Moderate	$M - 0,5 SD < X \leq M + 0,5 SD$
3	Height	$X > M + 0,5 SD$

Information:

X : Respondent's score (generated value student)

M : Mean / average

SD : Standard Deviation

3. Results and Discussion

Knowledge of Landslides

Respondents earned points vary greatly from the landslide questionnaire. Of the 10 statements about landslides, a respondent knows 4 points about landslides, as many as 3 respondents know 5 points about landslides, as many as 4 respondents know 7 points about landslides, as many as 18 respondents know 8 points about landslides, as many as 15 respondents know 9 points about landslides, and as many as 12 respondents know 10 points about land landslide (Figure 1). Gain diversity points about landslides show that respondents have that knowledge different about landslide disasters. These points will then be grouped into the three categories provided.

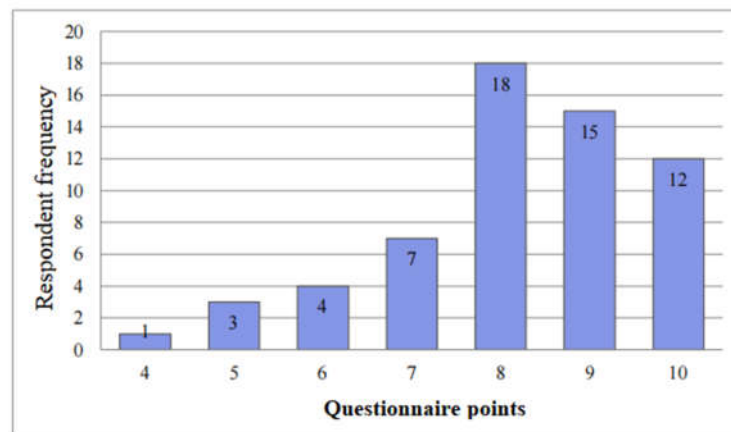


Fig. 1. Number of statements known to respondents from the land questionnaire Avalanche

Acquisition of respondent points on landslide questionnaire will determine value interval in the category of student knowledge about landslides. Knowledge level about landslides divided into three categories consisting of low categories, moderate, and high. Category level of knowledge about landslides with value intervals ≤ 7.45 including categories low, the value of $7.45 - 8.92$ medium category and value > 8.92 high category (Table 2). Student included in the level category low knowledge of 15 people (25%), moderate level of knowledge as many as 18 people (30%) and a high level of knowledge as much 27 people

(45%) (Figure 2). Processing results questionnaire about landslides from students in SDN Cipayang 07 shows that the majority of students have a level of knowledge high about landslide disasters.

Table 2. Knowledge level categories about landslides

No	Category	Range Points
1	Low	$X \leq 7.45$
2	Moderate	$7.45 < X \leq 8.92$
3	Height	$X > 8.92$

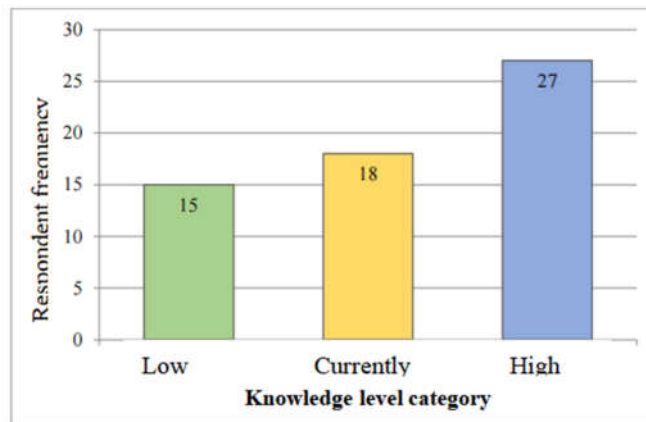


Fig. 2. Distribution of knowledge level about landslides

The majority of respondents already have High knowledge about land disasters Avalanche. Students by level category High knowledge has a number at most but the amount is still less than half of the total respondents. Student with the category of low knowledge level also quite a lot, so necessary There are other attempts to improve knowledge of respondents about land disasters Avalanche.

Knowledge of Land Mitigation Avalanche

Respondents earned points vary widely from the soil mitigation questionnaire Avalanche. Of the 10 statements about mitigation landslides, as many as 6 respondents have know 5 points about land mitigation landslides, as many as 10 respondents knew 6 points, as many as 25 respondents know 7 points, as many as 10 respondents know 8 points, as many as 8 respondents know 9 points, and as much as 1 respondent knows 10 points on landslide mitigation show in Figure 3.

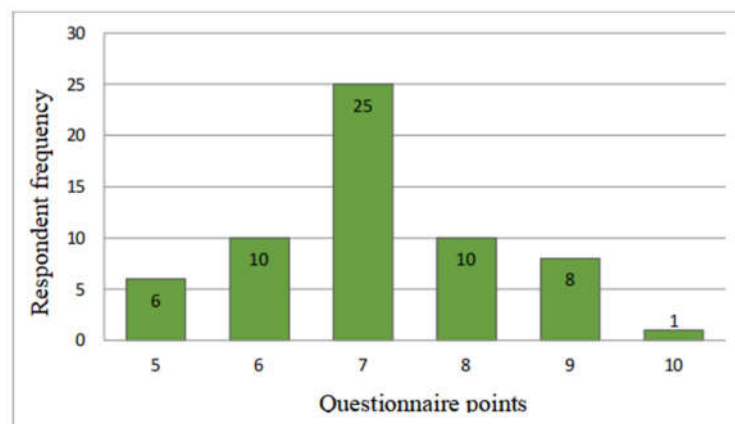


Fig. 3. Number of statements known to respondents from the mitigation questionnaire landslide

The diversity of points earned on mitigation landslides indicate respondents researchers have different knowledge about landslide mitigation. this point then grouped into three available categories.

Mitigation questionnaire respondent points landslides will determine the value interval in the category of students' knowledge about landslide mitigation. Knowledge level regarding landslide mitigation is divided into three categories consisting of low categories, moderate, and high (Syarifudin, 2010). Intervals value ≤ 6.52 is included in the low category, the value of 6.52-7.71 is in the moderate category and the value is > 7.71 high category (Table 3). Students included in the category of low knowledge level as many as 16 people (26.67%), level moderate knowledge as many as 25 people (41.67%), and a high level of knowledge as many as 19 people (31.67%) show in Figure 4.

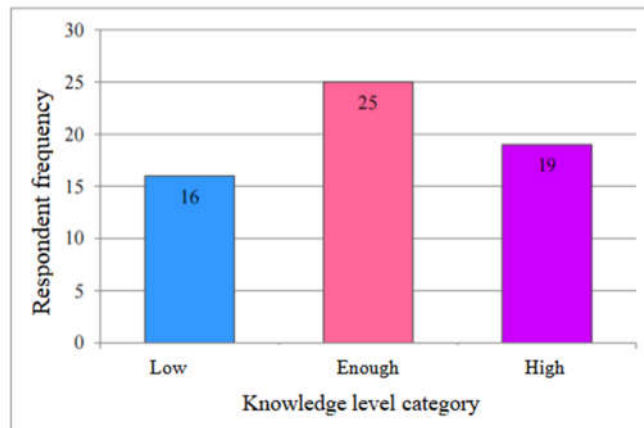


Fig. 4. Distribution of knowledge levels on landslide mitigation

Results processing of landslide mitigation questionnaires of students at SDN Cipayung 07 shows that the majority of students have a degree current knowledge of mitigation landslide.

Table 3. Knowledge level categories on landslide mitigation

No	Category	Range Points
1	Low	$X \leq 6.52$
2	Moderate	$6.52 < X \leq 7.71$
3	Height	$X > 7.71$

The majority of respondents have a level current knowledge of mitigation landslide. Students by level category relatively few high knowledge and still less than half the total respondent. Students with any level of knowledge low, the number is still quite a lot, so there needs to be effort to increase the knowledge of respondents about landslide mitigation. Obtain landslide questionnaire total points of 491. This number is higher compared to the number of points of the mitigation questionnaire landslides amounted to 427. These results shows that students at SDN Cipayung 07 has higher insight about landslide disaster compared to insight on landslide mitigation. these conditions This could be due to an imbalance sending or receiving information about landslide disaster and mitigation landslides so that students know more about the landslide disaster than mitigation or land management Avalanche

Knowledge of students at SDN Cipayung 07 regarding higher landslides compared to mitigation knowledge. The majority level of knowledge of landslides high category, while knowledge moderate landslide mitigation. The category shows there are still many students who lack understanding of landslide mitigation, there are still many students who are confused about how to save themselves when landslide occurred, still do not recognize signs of landslides and yet Learn how to prevent landslides. This condition can occur due to a lack education given to children, lack of existing facilities and infrastructure, or little interest of children in understanding landslides and mitigation.

Landslide Prevention Efforts

Several attempts can be made to prevent landslides as follows, if there is a crack in the slope, then the crack should be immediately covered with compacted soil Watertight to minimize water ingress rain into the cracks Reduce the thickness of the soil or slopes prone to landslides. Planting slopes with plants that are Its roots can penetrate the layers of bedrock. Installation of intact stone on the footpath, to reduce the surface area of the land thereby reducing the absorption of rainwater. Construction of a functioning drainage channel drain rainwater, so it is not absorbed by land.

4. Conclusion

The majority of respondents at SDN Cipayung 07 has high knowledge about landslide disaster. A total of 27 respondents (45%) have high knowledge about landslides, 18 respondents (30%) moderate knowledge and 15 respondents (25%) have low knowledge about soil Avalanche. Meanwhile, the majority of respondents still have moderate knowledge on landslide mitigation. A total of 19 respondents (31.67%) have knowledge about landslide mitigation, 25 respondents (41.67%) have moderate knowledge and 16 respondents (26.67%) knowledgeable low on landslide mitigation. Kindly all research respondents have good knowledge of the soil landslides and landslide mitigation, however there needs to be another effort to improve respondent's knowledge. In an effort to prevent soil Landslide can be done in several ways such as the use of gabions to hold the soil, cover the slope cracks with loose soil dense, reducing soil thickness or slopes, planting slopes with plants that accordingly, planting stones in the footpath, and make good drainage channels.

Suggestion

- In an effort to increase knowledge students can do the installation and recognition of emergency signs and alerts danger around school.
- Put up posters in every classroom which contains pictures about disaster or how to save yourself from disaster.
- Carry out simulation activities save yourself from disaster.
- Similar research needs to be carried out in some other elementary schools to order more represents the state of student knowledge elementary school about landslides and landslide mitigation.
- It is necessary to conduct research into schools with a higher level of education to further study the factors influencing mitigation knowledge landslide.

Acknowledgment

Special thanks to the internal funder for community service from the Universitas Sahid Jakarta.

Author Contribution

Plan of activities in the context of implementing the solutions offered to overcome the disaster landslade in disaster mitigation.

Funding

Special thanks to the internal funder for community service from the Universitas Sahid Jakarta.

Conflict of Interest

The authors declare no conflict of interest.

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