

Analysis of Earthquake Information in Palu from Social Media X (Twitter) in the Perspective of Geography Learning

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Abstract

The earthquake that struck Palu and surrounding areas on September 28, 2018 triggered extensive information dissemination on social media, particularly on platform X (formerly Twitter). However, the characteristics of disaster related information shared by users and its potential use in geography learning have received limited attention. This study aims to analyze the distribution and characteristics of information related to the Palu earthquake on Twitter and examine its potential as contextual material for geography education. This research employed qualitative content analysis supported by descriptive quantitative data. Tweets containing the keywords “Gempa Palu”, “#GempaPalu”, and “#PrayForPalu” posted between September 28 and October 31, 2018 were collected using the Twitter API and processed with Google Colab. After the data cleaning process, 117 relevant tweets were analyzed based on information type, temporal patterns, spatial references, and sentiment tendencies. The results show that reports on damage and victims were the most dominant content 41,03%, followed by official information and aid related activities. Temporal analysis indicates that tweet activity peaked on the first day after the disaster, while spatial references were mainly associated with Talise, Petobo, and Donggala. Sentiment analysis reveals that neutral posts accounted for 82,4% of the data, indicating that Twitter was primarily used to disseminate factual information during the disaster. These findings highlight the potential of social media data as contextual learning resources to support spatial analysis and disaster literacy in geography education.

Keywords: Palu earthquake, Twitter, disaster information, geography learning, social media data

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1. Introduction

Indonesia is known as an archipelago because it has thousands of islands stretching from Sabang in the west to Merauke in the east. This geographical condition makes Indonesia prone to various types of natural disasters. This is reinforced by Indonesia's location at the meeting point of four major tectonic plates; namely Eurasia, Indo-Australia, Pacific, and Philippine Sea. This position means that Indonesia is surrounded by sea and mountains, thereby increasing the potential for natural disasters (Prasetio et al., 2023).

Earthquakes are geological phenomena that occur as a result of plate shifts in the Earth's crust (Faridzi et al., 2024). These events are destructive because they almost always cause material and immaterial losses. The mechanisms that cause earthquakes vary, for example, due to fault activity, megathrust subduction processes, underground fluids, and volcanic activity. Given their significant impact, it is necessary to raise awareness among Indonesians about the importance of knowledge and skills in disaster mitigation. However, in reality, most people still have limited understanding of the causes of disasters and the appropriate steps to take when a disaster occurs. This situation often results in people being unable to respond quickly and effectively, especially in providing initial assistance to others who have been affected (Nugroho, 2022).

The earthquake that shook Palu and its surrounding areas on September 28, 2018, had a magnitude of 7.4 on the Richter scale at 17:02 local time. The strong tremors were followed by a tsunami that hit the coastal areas, particularly Talise Beach in Palu and Donggala. The disaster caused extensive humanitarian, physical, and socio-economic impacts. Official reports indicate that approximately 2,113 people lost their lives, more than 4,600 were injured, and over 220,000 residents were displaced (Rusydi et al., 2018). In addition, more than 68,000 housing units were damaged, along with significant impacts on public facilities such as roads, bridges, schools, hospitals, and ports. The economic losses were estimated to reach trillions of rupiah, reflecting the severe disruption to social life and economic activities (Anwar & Mahpuddin, 2020). These statistical data demonstrate that the impact of the earthquake extended beyond fatalities, encompassing infrastructure destruction and social system disruption. According to Barrow & Woods, (2006), education is considered a valuable process that is transmitted in a directed and ethically acceptable. Knowledge and society experience related to disasters are important aspects that must be provided to communities in need as a form of valuable asset (Fitriana, 2021). In the context of disaster risk reduction, education has a vital role because it is considered the most effective method to raise public awareness, especially among groups that are vulnerable to disasters. Moreover, education is also the fastest means of producing real and significant impacts in disaster risk mitigation efforts (Hamid, 2020).

In recent years, social media platforms have increasingly become important tools for disseminating disaster-related information. Among these platforms, X (formerly Twitter) has been widely used because of its ability to deliver real time information and facilitate rapid communication between authorities and the public. Previous studies have shown that Twitter plays a significant role in disaster management, particularly in the stages of early information dissemination, emergency coordination, and public communication. For instance, research results from Salsabela et al., (2023) highlights how official institutional accounts utilize Twitter to distribute mitigation messages and updates during disaster events. Similarly, other studies have demonstrated that social media can function as a channel for crowdsourced information, where individuals share firsthand reports, images, and situational updates during emergencies (BNPB, 2022).

Beyond its role as a communication medium, Twitter has also been examined as a valuable data source for understanding public responses and patterns of information flow during disasters. Posts shared on the platform often contain references to locations, affected areas, or geographical contexts, either through geotags, place names, or regional mentions. These characteristics allow researchers to analyze the spatial distribution of disaster-related information and identify areas that receive greater public attention. Therefore, the analysis of Twitter data does not only contribute to communication studies but also provides opportunities for geographical analysis, particularly in understanding how disaster information spreads across space and how communities respond to hazard events in different locations (Santoso, 2017).

From an educational perspective, analysis of X data on disasters can be used as a medium for contextual geography learning. The use of media that is interesting and easy to understand will greatly assist the learning process (Maulana et al., 2025). In line with the views of experts, the

use of appropriate learning media can significantly improve the quality of learning outcomes. In the context of geography learning, various types of media can be used, such as maps, pictures, realia, realia models, handouts, graphs, textbooks, transparencies, slides, filmstrips, and even moving visual media (Hidayat, 2024). Geography, as a science that studies spatial phenomena, is closely related to disasters. Geography learning is a process that examines various spatial aspects on the earth's surface, including natural phenomena and human life that are influenced by differences in regional characteristics (Hamid et al., 2022). The science of geography aims to combine the study of the physical environment and human activities as well as the reciprocal relationship between the two. Its main focus is on space, place, and territory, with an emphasis on analyzing short- and long-term processes and the patterns that emerge as a result of these processes (Meadows, 2020).

Through the use of real-time data from social media, students are not only encouraged to understand geographical concepts theoretically, but also trained to interpret spatial data, analyze spatial interaction patterns, and understand the relationship between humans and their environment. This actual data-based learning model is in line with the 21st century learning approach that emphasizes critical thinking skills, data literacy, and the use of digital technology (Warastuti et al., 2025). Several studies have been conducted on the use of social media as a disaster response system, such as the study conducted by Bakry (2023) on the #PrayForCianjur Research, which focused on social networks and key information actors using Social Network Analysis. Similarly, Salsabela et al (2023) focused on the role of the official @BNPB_Indonesia account in disseminating disaster mitigation information via Twitter using a descriptive qualitative approach, thus placing greater emphasis on institutional communication aspects. This study focuses on content analysis of disaster information uploaded by social media users on X (Twitter) during and after the 2018 Palu earthquake. Meanwhile, previous studies have examined the role of social media in disaster communication and information network analysis, research that explicitly connects the characteristics of disaster-related content with its application in geography education remains limited. Most existing studies emphasize crisis communication, actor network structures, or the effectiveness of information dissemination, without exploring the pedagogical potential of such digital data within formal education settings. Therefore, this study seeks to address this gap by analyzing how disaster-related information circulating on social media can be transformed into contextual learning resources that support the development of students' critical thinking skills, disaster literacy, and spatial understanding of geosphere phenomena.

Based on this background, research on the analysis of the distribution of information on the Palu earthquake based on X data is highly relevant. Firstly, to provide an overview of how disaster information is distributed in the digital space and its implications for disaster management. Secondly, the results of this study can be used as an innovation for geography learning resources that are more contextual, applicable, and in line with the needs of digital literacy in the global era. This approach positions social media not merely as an object of communication analysis, but as a relevant educational medium that strengthens geographic literacy through the use of digital data representing the interaction between natural dynamics and human social activities.

2. Method

This study is grounded in qualitative content analysis while incorporating limited quantitative description to support pattern identification. The primary analytical orientation remains interpretative, focusing on understanding the substance, context, and meaning of disaster related information shared on X (Twitter). However, to clarify the distribution of information types and sentiment tendencies, frequency counts and percentage calculations were employed as descriptive tools rather than inferential statistical measures (Salsabela et al., 2023).

The main data was collected from platform X (Twitter) using the keywords "Palu Earthquake,"

“#GempaPalu,” and “#PrayForPalu” during the period from September 28 to October 31, 2018. Data collection was carried out through the Twitter application programming interface (API) and web scraping techniques run in a cloud computing environment through Google Colab. Furthermore, secondary data in the form of official reports from the National Disaster Management Agency (BNPB), the Meteorology, Climatology, and Geophysics Agency (BMKG), and literature related to disasters and geography learning were used as supplementary material to enrich the interpretation of the analysis results. This procedure allowed researchers to combine social media perspectives with a geography learning framework to understand how information about the Palu earthquake circulated and could be used in a geography education constellation (Amriza & Ngafidin, 2021).



Figure 1. Research Data Analysis Process Flow

The analysis was conducted systematically. First and foremost, data collected through scraping was cleaned to avoid duplication, spam, and content irrelevant to the theme of disasters. Then, the cleaned data was extracted based on metadata, such as upload time, hashtag usage, and patterns of interaction between users. Furthermore, a content analysis procedure was conducted to classify the collected posts into predefined information categories. Each category was established based on operational criteria to ensure analytical consistency. “Official news” refers to posts containing factual updates originating from verified institutional accounts, government agencies, or recognized media outlets, typically reporting casualty numbers, infrastructure damage, or official statements. “Public opinion” includes personal reflections, emotional reactions, or subjective interpretations expressed by individual users. “Educational messages” encompass posts that provide disaster-related explanations, mitigation advice, preparedness guidance, or geographical insights intended to increase public understanding. “Social solidarity” covers expressions of empathy, prayers, moral support, and symbolic hashtags demonstrating collective concern. Meanwhile, “aid information” refers to posts that disseminate details regarding donations, logistics distribution, volunteer coordination, or relief assistance. These operational definitions guided the coding process to maintain clarity and reduce interpretative ambiguity. Following data collection and filtering, a structured coding procedure was implemented prior to interpreting the findings within the context of geography learning.

The coding process was conducted in several stages. To begin with, each tweet was treated as a single unit of analysis and assigned an identification number. Thus, open coding was carried out to identify key themes, keywords, and message characteristics contained in each post. Therefore, the initial codes were grouped into broader predefined categories, official news, public opinion, educational messages, social solidarity, and aid information, based on the established operational definitions. The interpreted results were subsequently contextualized within geography learning by aligning the identified information patterns with core geographical competencies. Disaster-related posts were utilized to support discussions on lithospheric dynamics, tsunami processes, spatial impact distribution, and human environment interaction. Through guided classroom

analysis, students can identify spatial references, examine patterns of impact concentration, and evaluate community responses to environmental risk. In this context, social media data serve as contextual empirical material that strengthens spatial literacy and disaster awareness in geography education.

The analysis was conducted through several systematic stages. First, the raw data obtained through the scraping process were subjected to a cleaning procedure to ensure the reliability of the dataset. Duplicate tweets were removed by identifying identical tweet IDs, while irrelevant posts were filtered using disaster related keywords associated with the Palu earthquake. Additionally, spam content or hoax was identified through several indicators, including repetitive promotional messages, automated or bot like posts, excessive use of unrelated hashtags, and identical text repeatedly posted within a short period of time. Accounts showing unusually high posting frequency without contextual relevance to the disaster were also excluded from the dataset. After the cleaning process, the dataset was organized using relevant metadata such as posting time, hashtag usage, and patterns of user interaction including replies, mentions, and retweets. These metadata were used to support the identification of information dissemination patterns during the disaster event.

A content analysis approach was then applied to classify the collected tweets into predefined information categories. The coding framework followed a systematic content analysis procedure as described by Krippendorff (2022), emphasizing the use of clear operational definitions to maintain analytical consistency. In this study, each tweet was treated as a single unit of analysis and categorized into several types of information. “Official news” refers to tweets containing factual updates originally from verified institutional accounts, government agencies, or recognized media outlets, usually reporting casualty numbers, infrastructure damage, or official statements. “Public opinion” includes personal reflections, emotional responses, or subjective interpretations expressed by individual users. “Educational messages” consist of tweets that provide explanations about disaster processes, mitigation strategies, preparedness guidance, or geographical insights intended to improve public understanding. “Social solidarity” refers to expressions of empathy, prayers, and moral support toward affected communities. Meanwhile, “aid information” includes posts related to donation activities, volunteer coordination, logistics distribution, or humanitarian assistance. In addition to content classification, sentiment analysis was conducted to identify the emotional tone of each tweet. The sentiment scoring applied a lexicon-based approach following the framework proposed by Liu (2012). In this approach, each word within a tweet is assigned a sentiment value based on a predefined sentiment dictionary. The sentiment score for each tweet was calculated using the following formula:

$$\text{Sentiment Score} = \Sigma (\text{positive word scores}) - \Sigma (\text{negative word scores}) \quad (1)$$

Tweets/posts with a positive score were categorized as positive sentiment, tweets with a negative score were classified as negative sentiment, and tweets with scores close to zero were considered neutral. This method allows the identification of dominant emotional tendencies in disaster-related conversations on social media. To ensure the validity and reliability of the analysis, an intercoder reliability test was conducted. A portion of the dataset was independently coded by two coders using the same operational definitions and classification categories. The level of agreement between coders was measured using Cohen’s Kappa coefficient developed by Jacob

Cohen (1960), which is widely used to assess reliability in content analysis studies. The reliability test indicated a satisfactory level of agreement between coders, demonstrating that the classification process was consistent and methodologically reliable (Mancar, 2022).

After the coding process was completed, the results were interpreted within the context of geography education. Disaster related tweets were used as contextual examples to support discussions on lithospheric dynamics, tsunami processes, spatial impact distribution, and human environment interactions. Through guided analysis, students can identify spatial references in social media information, examine patterns of disaster impact, and evaluate community responses to environmental risks. In this context, social media data serve as empirical learning material that supports the development of spatial literacy and disaster awareness in geography education.

3. Results and Discussion

A. Information Categories

Based on data collected from the social media platform X (Twitter) using the keywords “Gempa Palu”, “#GempaPalu”, and “#PrayForPalu” during the period from September 28 to October 31, 2018, a total of 117 tweets relevant to the Palu earthquake were identified. The dataset primarily consisted of original tweets posted by users. Retweets were reviewed during the data collection stage; however, only retweets that contained additional comments or contextual information were retained in the dataset, while simple reposts without additional content were excluded to avoid redundancy. In terms of spatial information, the dataset did not rely solely on strict geolocation filtering because only a small proportion of Twitter posts provide precise geographic coordinates. Instead, spatial references were identified through textual information such as location names mentioned within the tweets, user profile locations, or contextual references related to the affected region. This approach allows disaster-related information to be analyzed while still considering its geographical context. Barisione & Ceron (2017) explain that the use of hashtags on social media has transformed into a primary means of driving social issues or campaigns, replacing the role of institutions or groups that previously functioned as mediators of these movements. Meanwhile, according to Khairunnisa et al (2022), hashtags function as a mechanism for grouping digital content so that information can be organized systematically and easily found by users searching for specific topics on the internet. The collected data was then analyzed through data cleaning to remove duplicates, spam, and irrelevant information. The results of the content analysis show that tweets can be grouped into the following five main categories: check in Table 1.

Table 1. Categories of Information in Tweets about the Palu Earthquake (28 September – 31 October 2018).

Information Category	Number of Tweets/Posts	Percentage (%)
Damage and casualty report	48	41,03
Official information	16	13,68
Help & volunteer information	8	6,84
Personal experience/testimony	3	2,56
Emotional expression / solidarity	3	2,56
Hoaxes & misinformation	2	1,71
General commentary	21	17,95
Media resharing	16	13,68
Total	117	100

Source: Primary data from Twitter scraping, 2025

Based on content analysis of 117 tweets tagged “#GempaPalu,” it was found that the category of damage and victim reports was the most dominant, with a proportion of 41,03%. Posts in this category generally contained visual documentation and narratives related to the conditions of the affected areas, the number of victims, and infrastructure damage caused by the earthquake and tsunami. The relevance of this type of content describes that Twitter plays an important role as a medium for real time documentation and a source of field information when disasters occur. The official information category came next at 13,68%, dominated by posts from institutions such as BMKG and BNPB that conveyed earthquake data and early warnings. Meanwhile, aid and volunteer information reached 6,84%, illustrating the use of Twitter as a part of social coordination and dissemination of post-disaster logistical information. The integration of social media into community preparedness activities for emergency situations can help build social capital and community resilience. It makes effortless for both professional respondents and ordinary citizens to utilize social networks and well-known social media tools during emergency conditions (Findayani, 2020).

Personal experiences, testimonies, and expressions of emotion or solidarity contributed 2,56%, containing stories of survivors, expressions of empathy, and prayers for the victims. Meanwhile, hoaxes and misinformation appeared in small numbers, accounting for 1,71%, indicating that invalid information was still being spread, albeit in limited quantities. In addition to the dominant categories, two other forms of communication patterns were identified. The “General commentary” category 17,95% consists of contextual remarks or brief reactions related to the disaster without presenting structured factual updates or detailed reporting. These posts typically reflect situational awareness, short reflections, or general observations. Meanwhile, “Media resharing” 13,68% includes reposted news links, images, or videos circulated without additional analytical interpretation or personal narrative. The presence of these categories demonstrates the heterogeneous characteristics of disaster-related communication on social media, where informational, expressive, and redistributive functions coexist within the same digital space.

B. Temporal Patterns

Temporal analysis was conducted to examine the dynamics of disaster-related information dissemination over time on the social media platform X (formerly Twitter). Each tweet contains timestamp metadata indicating the exact time when the post was published. These timestamps were extracted from the dataset and aggregated into two temporal scales in order to observe both short-term and longer-term patterns of information circulation can be seen in Table 2.

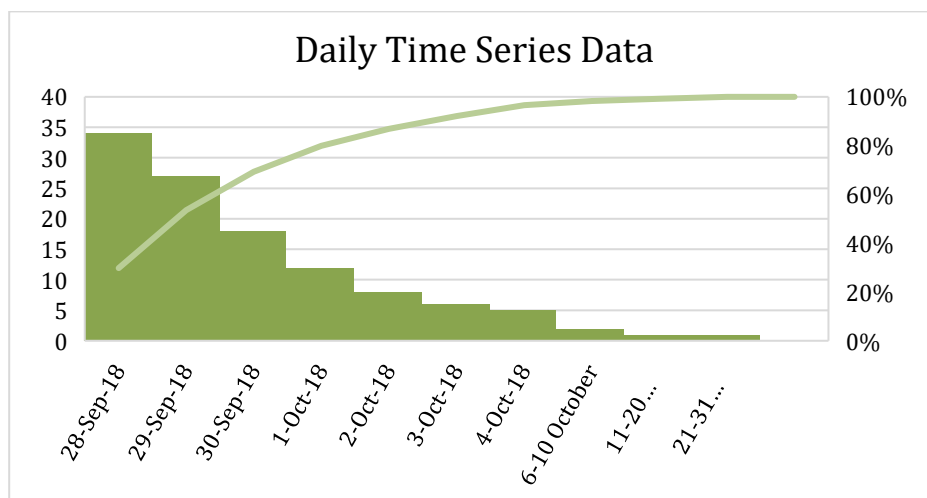


Figure 2. Daily Time-Series Distribution of Tweets Related to the Palu Earthquake (September - October 2018).

To begin with, a daily time-series analysis was performed to identify fluctuations in tweet activity during the observation period from 28 September to 31 October 2018. The results presented in Figure 2 show that the highest number of tweets occurred on the first day of the disaster, with 34 posts recorded on 28 September 2018. The following day also showed high activity with 27 tweets/posts. After the first three days, the number of tweets gradually declined, indicating a decrease in public attention as the emergency phase progressed into the recovery period. Furthermore, an hourly analysis was conducted to examine the distribution of tweets during the first 24 hours after the earthquake. As illustrated in Figure 3, the intensity of posts upwards rapidly during the first few hours following the event. The peak activity occurred between 20:00 and 21:00, when the highest of tweets was recorded. After midnight, the frequency of tweets gradually decreased. Meanwhile discussions about the disaster continued the following hours.

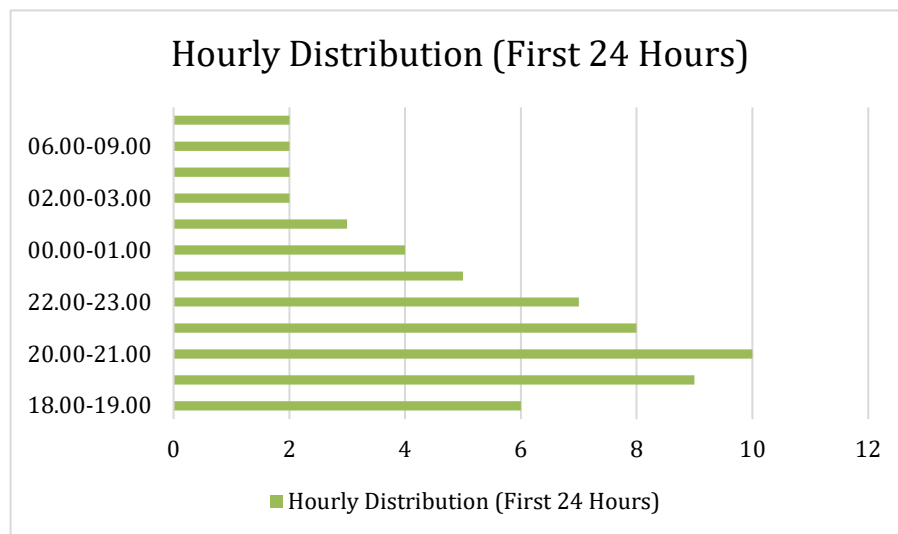


Figure 3. Hourly Distribution of Tweets during the First 24 Hours after the Palu Earthquake.

A closer temporal examination of the 117 collected tweets also reveals how information dynamics shifted across different phases of the disaster. Approximately 21,37 % of the tweets were posted within the first three hours after the earthquake. During this initial phase, the timeline was dominated by spontaneous posts from individuals in affected areas. The content mainly consisted of visual documentation and narrative descriptions of damaged buildings, cracked roads, evacuation attempts, and immediate self-rescue efforts. Although many of these posts were emotional and not yet verified, they functioned as real-time documentation of on-site conditions (Bakry, 2023). In the subsequent six to twelve hours, around 24,79% of tweets were recorded. During this period, structured information from official accounts such as @infoBMKG and @BNPB_Indonesia became more visible, providing earthquake parameters, epicenter coordinates, and early tsunami warnings. However, several unverified posts also emerged, including exaggerated predictions of stronger aftershocks. This pattern suggests that while institutional accounts contributed to improving informational clarity, user-generated content remained quantitatively significant and had the potential to amplify uncertainty or public concern (Salsabela et al., 2023).

On the second to fifth days, the pattern of posts shifted further. The public, non-governmental organizations, and volunteer groups widely disseminated information about logistics distribution, evacuation center locations, and calls for donations. This change indicates that the function of Twitter evolved from a documentation platform into a tool for social mobilization supporting the emergency response phase (Mulyani et al., 2022). Furthermore, during the second week until the end of October 2018, the overall intensity of posts decreased. Nevertheless, the dominant content

consisted of expressions of solidarity, prayers, and moral support. Hashtags such as #PrayForPalu emerged as symbols of collective empathy, indicating that the Palu disaster was not only perceived as a local tragedy but also as a global humanitarian issue (Meadows, 2020). From a geography education perspective, these temporal dynamics provide a valuable real-world illustration of the stages of disaster management. The evolving patterns of information circulation reflect how public communication needs change during different phases of a disaster, from immediate impact and emergency response to recovery and social solidarity. Therefore, social media data such as this can serve as contextual learning material to help students understand disaster response processes, spatial awareness, and environmental risk within geography education (Fitriana, 2021).

C. Spatial Patterns

Information circulating on Twitter often mentions specific locations such as Palu, Donggala, Petobo, and Talise. This provides an opportunity to analyze spatial patterns in disaster events. In the spatial coding stage, each tweet was examined to identify references to geographic locations mentioned in the text. When a post contained more than one place name, the classification was determined based on the location that received the greatest emphasis or formed the central context of the message. This decision was made to ensure analytical consistency and to prevent double counting within the distribution table. Consequently, each tweet was assigned to only one spatial category, even if multiple areas were mentioned. This approach allows the distribution percentages to reflect the dominant spatial focus of public discourse rather than the total frequency of all location mentions.

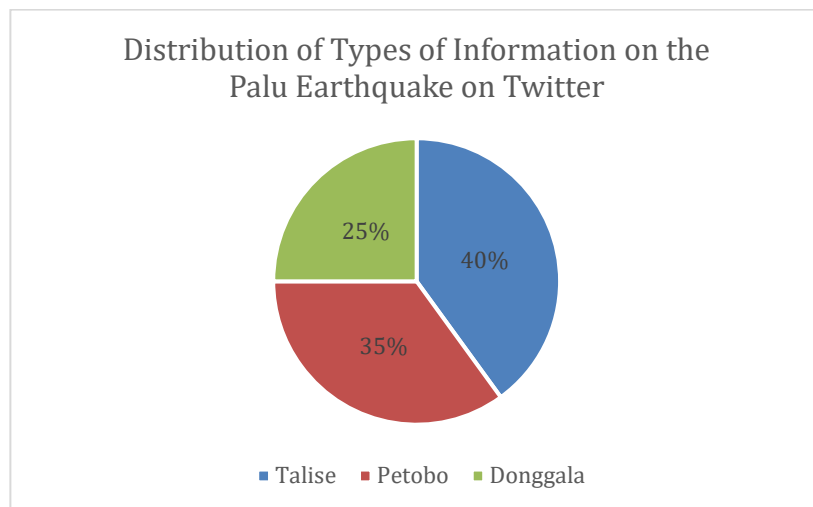


Figure 4. Distribution of Types of Information about the Palu Earthquake on Twitter (X)

Based on the results of data analysis visualized through a pie chart, the distribution of information about the Palu earthquake shows significant spatial variation between affected areas. The Talise area accounts for the largest proportion, namely 40%, indicating that this area is the main focus of conversation on Twitter. The high intensity of information directed at Talise cannot be separated from the impact of the tsunami that hit the coast and caused severe damage to infrastructure and residential areas. This phenomenon shows that people tend to focus more on areas with high visual damage and social impact, as explained by Nurhazizah et al., (2022), that public perception of disasters on social media generally increases with high visual exposure and emotional closeness to the disaster location. Fellow social media users connected within a network can help by sharing requests or offering direct assistance (Dicarlo & Berglund, 2021).

Meanwhile, the Petobo area accounted for 35%, ranking second in terms of information

distribution. Petobo is known as an area that experienced extreme liquefaction, where the ground melted, causing many settlements to sink and disappear from the surface. Many posts on Twitter highlighted this event because it was considered a rare and tragic geological phenomenon. This finding is in line with the results of research by Silviana et al., (2025), which shows that unique phenomena such as liquefaction can reinforce public narratives on social media, especially when it comes to the physical and emotional loss of the affected community. Thus, the high proportion of information from Petobo not only illustrates the extent of material damage, but also shows the strong social dimension in online disaster communication and effect of society by liquefaction (Novarita et al., 2024). The Donggala region contributed 25% of the total distribution of information. Although its proportion was smaller than the other two regions, Donggala was one of the first areas to experience strong tremors due to its proximity to the epicenter of the earthquake. The information circulating about this region was mostly related to initial reports of the incident, early warnings, and damage to infrastructure such as roads and ports. This proportion illustrates how geographical proximity to the epicenter of the earthquake affects the intensity of initial information appearing on social media.

According to Samatan et al., (2020) spatial location has an important influence on disaster communication patterns on Twitter, where areas close to the epicenter tend to dominate the initial phase of information dissemination. The differences in proportions between Talise, Petobo, and Donggala reflect that the level of damage and public attention are influenced by the physical geographical conditions of each region. Talise, as a coastal area, is vulnerable to tsunami waves, Petobo, which is located in a low-lying area with fragile geotectonic conditions, is vulnerable to liquefaction, while Donggala, which is close to the epicenter, experienced more direct impacts from seismic shocks. This distribution pattern shows a close relationship between the physical characteristics of the region and the intensity of information dissemination in the digital space. Moreover, (Nisa' et al., 2024) revealed that development of mitigation adaptation should process of digital media.

Despite the identifiable variation in location-based discussions, it is necessary to clarify that the spatial interpretation in this study is derived primarily from textual references to place names within tweets rather than from embedded geospatial coordinates. The majority of the analyzed posts did not contain geotagged metadata such as latitude and longitude. As a result, the classification of Talise, Petobo, and Donggala was based on explicit mentions in the tweet content. This approach enables an understanding of how particular areas were represented in public discourse; however, it does not guarantee that the users posting the information were physically located in those areas at the time of publication. Consequently, the spatial pattern described in this study reflects the intensity of digital attention toward specific locations rather than a precise geospatial mapping of disaster impacts. This limitation should be considered when interpreting the findings, particularly in distinguishing between patterns of online representation and actual physical distribution of damage.

D. Relevance in Geography Learning

Research findings indicate that the distribution of information related to the Palu earthquake on Twitter can be systematically integrated into geography learning through structured classroom activities. The empirical data obtained from social media provide authentic material that reflects both the physical impacts of disasters and the social responses of affected communities. In an instructional context, these data can be implemented through a four stage learning model based on inquiry and data analysis. In the first stage, students are introduced to selected tweets related to the Palu earthquake containing information about damage, casualties, evacuation, and community responses. Students are asked to identify different types of information and categorize them into several groups such as official news, public opinion, mitigation messages, social solidarity, and aid information. The second stage focuses on spatial analysis activities. Students

analyze references to locations mentioned in tweets, such as Talise, Petobo, and other affected areas. Connecting these references with maps or geographic information, students can examine the spatial relationship between physical environmental conditions and the level of disaster impact. For instance, the vulnerability of coastal areas to tsunami hazards and the occurrence of liquefaction in specific settlements can be discussed within the framework of human environment interaction.

In the third stage, students conduct source verification and digital literacy exercises. Tweets originating from personal accounts are compared with information released by official institutions such as the Indonesian Meteorology, Climatology, and Geophysics Agency (BMKG) and the National Disaster Management Agency (BNPB). This activity enables students to evaluate the credibility of information and to identify misleading or unverified content circulating during disaster situations. The fourth stage involves knowledge synthesis and communication practice. Students are assigned to design short disaster mitigation messages based on verified information obtained from the analysis. Through this activity, students learn how accurate information can contribute to public awareness and disaster preparedness. This learning practice is consistent with disaster mitigation education which aims to equip students with knowledge and practical skills so that they are able to understand disaster risks in everyday life (Putra, 2025). Through these learning steps, social media data function not only as communication artifacts but also as empirical learning resources that support spatial analysis, disaster literacy, and critical thinking in geography education. The use of real data from X (Twitter) enables students to examine the spatial relationship between natural hazards and social conditions, thereby strengthening the development of geographic literacy (Rofiyanti et al., 2023).



Figure 5. Word cloud analysis results
Source: Researcher's work (Google Colab, 2025).

The word frequency analysis presented in Table 2 supports the visual pattern shown in the word cloud. The terms “earthquake” and “Palu” appear most frequently, followed by location specific references such as “Donggala” and “Central Sulawesi,” as well as impact-related words such as “victims,” “aid,” and “tsunami.” This distribution confirms that public discourse focused primarily on affected locations and humanitarian consequences.

Table 2. Word Frequency Distribution in Tweets about the Palu Earthquake

No	Word	Frequency
1.	earthquake	64
2.	palu	59
3.	donggala	34
4.	victims	29
5.	aid	24

6.	tsunami	22
7.	central	20
8.	sulawesi	20
9.	volunteers	17
10.	liquefaction	15
11.	prayforpalu	14
12.	damage	13
13.	evacuation	11
14.	disaster	10
15.	help	9

Source: Processed tweet data (Google Colab analysis, 2025).

The results of the word cloud analysis of tweets containing the hashtag “#GempaPalu” reveal several dominant terms that characterize public discourse on the social media platform X (Twitter). The analysis was conducted using a text mining procedure in which the tweet corpus was processed through several stages, including text cleaning, tokenization, and the removal of common stopwords. A total of 117 tweets collected during the observation period were included in the analysis to identify the most frequently occurring words within the dataset. During preprocessing, common stopwords and punctuation were removed to reduce linguistic noise; however, shortened hyperlink indicators such as “https” and “t.co” were retained in the corpus in order to capture patterns of external link sharing in disaster-related communication. The visualization of the word cloud was then generated to illustrate the relative frequency of keywords appearing in the tweets. The analysis shows that the most prominent words in the dataset are “earthquake,” “Palu,” “Donggala,” “victims,” “aid,” and “Central Sulawesi.” The prominence of these terms reflects the main topics discussed by users in relation to the disaster event. The frequent occurrence of geographical references such as “Palu,” “Donggala,” and “Central Sulawesi” indicates that users consistently mentioned the affected locations when sharing information about the disaster. This pattern demonstrates that public conversations on social media often contain spatial references that implicitly map the perceived location of disaster impacts. In this context, the presence of place names within digital communication can be interpreted as a form of spatial representation in online discourse. This observation supports the argument proposed by Meadows, (2020) that digital geographic literacy enables users to interpret relationships between physical locations and their representation within virtual communication environments.

In addition to geographical terms, the appearance of words such as “victims,” “aid,” “prayers,” and “volunteers” highlights the strong humanitarian dimension in the online conversation. These terms indicate that social media users were not only discussing the physical impacts of the earthquake and tsunami but were also actively expressing empathy, solidarity, and support for affected communities. Furthermore, the frequent appearance of the terms “https” and “t.co” suggests that many tweets included hyperlinks directing users to external sources such as news portals, government announcements, or humanitarian organization updates. The presence of these links indicates that Twitter functioned not only as a platform for personal expression but also as a medium for redistributing information originating from other digital sources. This finding is consistent with (Salsabela et al., 2023) who argue that Twitter plays an important role in cross-platform information dissemination during disaster situations, thereby expanding the circulation of crisis-related information in the digital environment.

From a Geography learning perspective, the results of this word cloud analysis are highly relevant. Data showing the relationship between location, impact, and social activities can be used as a contextual learning resource to train students to understand the concepts of spatial interrelationships and human-environment interactions. Through the visualization of words that emerge from real data, teachers can guide students to analyze the distribution of disaster topics, identify the physical and social aspects of an area, and foster geographic and disaster literacy.

This is in line with Fitriana (2021) view that learning based on actual phenomena can improve students' spatial analysis skills and environmental awareness. Thus, word clouds not only function as linguistic data visualization tools, but also as educational instruments that enrich students' understanding of the dynamics of space, society, and the environment in the context of disasters.

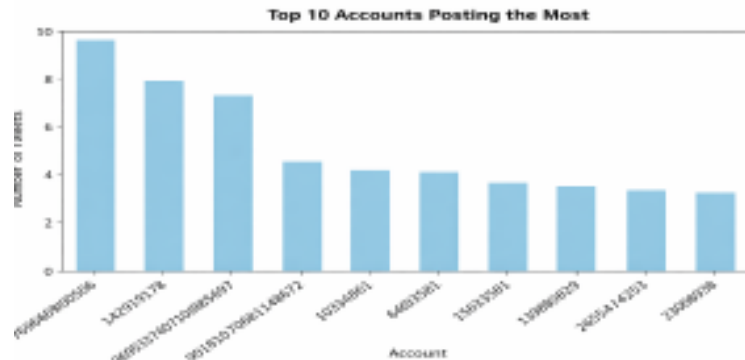


Figure 6. Top 10 posts X (Twitter)

The graph shows that the dissemination of information related to the Palu earthquake on Twitter was dominated by a small number of highly active accounts. To better understand the actors involved in the circulation of disaster information, the accounts were classified into several categories based on their profile descriptions and communication characteristics, namely official institutional accounts, media or news accounts, and personal user accounts. The analysis indicates that account 761533969863805056, which belongs to a personal user, produced the highest number of posts with a total of 10 tweets during the observation period. Meanwhile, accounts 142918176 and 96957407401885697 posted 8 and 7 tweets respectively and are categorized as media-related accounts that primarily disseminate news updates and public information. Other accounts appearing in the dataset were mostly individual users and community members, each contributing only 3 to 4 tweets during the research period. This pattern suggests that the circulation of disaster-related information on Twitter is largely driven by a limited number of active actors who function as important nodes in the information network. In disaster situations, such actors play a significant role in accelerating the spread of information to a wider audience. From the perspective of geography education, these findings underline the importance of strengthening digital literacy skills, particularly in recognizing different types of information sources and understanding how communication networks operate during disaster events (Bahri & Tabbu, 2022).

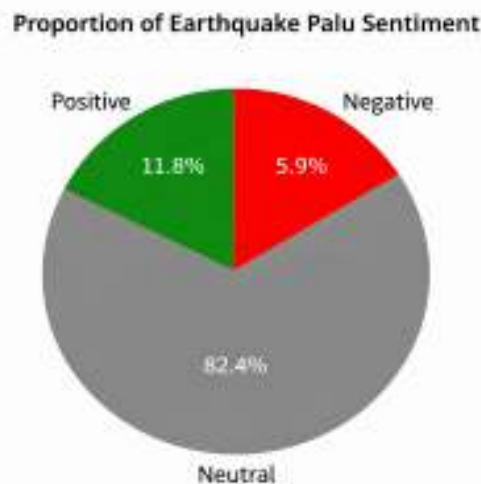


Figure 7. Sentiment Analysis of the Palu Earthquake
Source: Researcher's work (Google Colab, 2025)

Sentiment analysis of posts tagged “#GempaPalu” shows that the majority of tweets are neutral, with a proportion of 82,4%, followed by positive sentiment at 11,8% and negative sentiment at 5,9%. The dominance of neutral sentiment shows that most Twitter users use this platform to disseminate factual information related to disasters, such as reports on field conditions, the number of victims, infrastructure damage, and updates from official agencies. Posts in this category tend to be informative, descriptive, and not accompanied by excessive emotional content. This phenomenon shows that the public uses social media not only as a means of expression, but also as a space for sharing data and public communication during emergency response periods. These findings are consistent with the results of research by Salsabela et al. (2023), which explains that Twitter functions effectively as a real-time information channel during disasters because of its open, fast nature and its ability to disseminate messages across regions directly.

Meanwhile, positive sentiment in posts reached 11,8%, which generally took the form of expressions of empathy, prayers, and moral support for victims and affected communities. Hashtags such as #PrayForPalu became a symbolic form of digital solidarity, showing how online spaces have transformed into a medium for collective psychological reinforcement. This phenomenon is in line with Meadows (2020) view that social interaction in the context of disasters has a geographical dimension because it shows emotional connections between regions that transcend spatial boundaries. In other words, social media users from various regions and even other countries can participate in expressing their concern for the events that occurred in Palu (Santi et al., 2022). In contrast, negative sentiment only reached 5,9%, which generally appeared in the form of criticism of the slow response to the disaster, complaints about the distribution of aid, or expressions of disappointment with local governments and related institutions. This small proportion indicates that despite social criticism, the public discourse on Twitter during the Palu disaster was relatively conducive and focused on spreading positive information. This shows a balance in digital communication between public emotions and the need for factual information (Pratiwi et al., 2022).

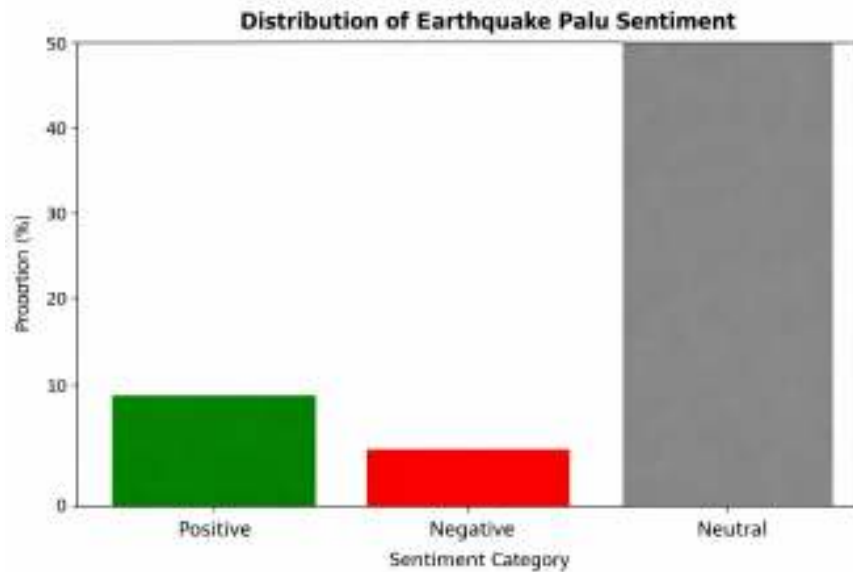


Figure 8. Distribution of Sentiment Regarding the Palu Earthquake
Source: Researcher's work (Google Colab, 2025).

The results of sentiment distribution analysis of posts tagged “#GempaPalu” show that public perception on social media X (Twitter) is dominated by neutral sentiment, accounting for 82,4%, followed by positive sentiment at 11% and negative sentiment at 6,84%. The dominance of neutral sentiment indicates that most Twitter users use the platform as a medium for disseminating factual information, rather than as a means of expressing personal emotions. Posts with neutral sentiment generally consist of reports on the current situation, updates on the situation on the ground, data on the number of victims, and information from official agencies such as the BMKG and BNPB. This pattern shows that Twitter has functioned as a data-based disaster communication space, where the public plays an active role in distributing informative and descriptive information. These findings are in line with the views of Salsabela et al. (2023), who emphasize that Twitter plays an important role in establishing fast, open, and decentralized public communication when disasters occur.

Meanwhile, positive sentiment, which reached 11%, showed expressions of social empathy and humanitarian solidarity. Posts in this category mostly contained prayers, moral support, calls to help victims, and expressions of concern for the people of Palu and its surrounding areas. The use of hashtags such as #PrayForPalu showed that the digital community was helping to build an emotional network that transcended geographical boundaries. This phenomenon reinforces the concept of interregional interaction in social geography, as stated by Meadows (2020), that human connectivity through digital space reflects non-physical spatial relationships that have a real social impact. Thus, social media is not only a medium for conveying messages, but also a means of strengthening humanitarian values and solidarity across regions. On the other hand, negative sentiment, which only reached 6,84%, reflects a relatively low level of conflict or tension in online conversations about the Palu disaster. Posts with negative content generally took the form of criticism of the slow response to the disaster, the unequal distribution of aid, or disappointment with the government's response. Although small in number, the existence of this sentiment is still important as an indicator of public evaluation of the effectiveness of policies and communication by relevant institutions. However, the low proportion indicates that the digital space during the emergency response period was characterized more by solidarity and a desire to help than by destructive emotional debates.

4. Conclusion

The results of the study show that information about the Palu earthquake disseminated through social media X (Twitter) was dominated by reports of damage and casualties, with the highest percentage at 41,03%, followed by official information and posts related to social assistance. This pattern shows that Twitter acts as a responsive and participatory space for disaster communication, where the public contributes to the dissemination of field data and real-time updates on the situation. Sentiment analysis shows a tendency for posts to be neutral and factual, indicating that social media is used more as a source of information and public coordination than as a means of emotional expression. From a Geography learning perspective, the results of this study are highly relevant because they can be used as a contextual learning resource that encourages students to understand the relationship between natural phenomena, social conditions, and community responses. Through the use of social media data, students can be trained to develop disaster literacy, think critically about spatial information, and understand the real interactions between humans and the environment. Thus, integrating social media analysis results into the learning process not only enriches teaching materials but also strengthens geography literacy as the basis for building disaster awareness among students.

5. References

- Amriza, R. N. S., & Khairun Nisa Meiah Ngafidin. (2021). Analisis Pengaruh Platform Sosial Media Terhadap Penyebaran Informasi Bencana. *JSiI (Jurnal Sistem Informasi)*, 8(2), 82–87. <https://doi.org/10.30656/jsii.v8i2.3639>
- Anwar, S., & Mahpuddin. (2020). Pengaruh Pemberitaan Bencana 28 September 2018 Di Kompas Tv Terhadap Tingkat Kecemasan Kerabat Korban Di Kota Makassar. *Kinesik*, 7(1), 73–81. <https://doi.org/10.22487/ejk.v7i1.48>
- Bahri, A., & Tabbu, M. A. S. (2022). *The Impact Of Digital Literacy And Disaster Mitigation Understanding On Computational And Spatial Thinking Ability In Upper Secondary School*. 312–325.
- Bakry, G. N. (2023). Analisis jejaring sosial gempa Cianjur di Twitter sebagai mitigasi dampak bencana. *Jurnal Studi Komunikasi (Indonesian Journal of Communications Studies)*, 7(3), 977–993. <https://doi.org/10.25139/jsk.v7i3.5826>
- Barisione, M., & Ceron, A. (2017). Social Media and European Politics. *Social Media and European Politics, February*. <https://doi.org/10.1057/978-1-137-59890-5>
- Barrow, R., & Woods, R. (2006). An introduction to philosophy of education. *An Introduction to Philosophy of Education*, 1–200. <https://doi.org/10.4324/9780203969953>
- BNPB. (2022). *Dokumen kajian risiko bencana nasional provinsi sulawesi tengah 2022 - 2026*.
- Dicarlo, M. F., & Berglund, E. Z. (2021). Connected communities improve hazard response: An agent-based model of social media behaviors during hurricanes. *Sustainable Cities and Society*, 1(1), 69. <https://doi.org/10.29303/jima.v1i1.1204>
- Faridzi, S. Al, Azizah, F. S., Mustafa, F., & Putri, A. N. (2024). *Pengolahan Data: Pemahaman Gempa Bumi Di Indonesia Melalui Pendekatan Data Mining*. 2(1), 262–270.
- Findayani, A. (2020). Peran Sosial Media dalam Penyampaian Informasi dan Kesiapsiagaan Masyarakat Menghadapi Covid-19 di Kota Semarang. *Jurnal Geografi: Media Informasi Pengembangan Dan Profesi Kegeografian*, 17.2 (2020).
- Fitriana, E. (2021). Pendidikan siaga bencana: pendekatan dalam pembelajaran geografi. *Meretas: Jurnal Ilmu Pendidikan*, 8(1), 72–87.
- Hamid, N. (2020). Urgensi pendidikan kebencanaan kepada masyarakat. In *Mass Communication*

- and Society* (Vol. 3, Issue 10, pp. 349–383). https://doi.org/10.1163/_q3_SIM_00374
- Hamid, N., Setyowati, D. L., Juhadi, J., Priyanto, A. S., Wijayanti, N. R., & Aroyandini, E. N. (2022). Peran Pendidikan Formal, Keluarga, dan Masyarakat dalam Pendidikan Bencana. *Prosiding Seminar Nasional Pascasarjana UNNES 2021*, 403–409.
- Hidayat, N. R. (2024). Pemanfaatan Media Pembelajaran Geografi Berbasis Media Sosial Instagram Terhadap Aktivitas Siswa. *Jurnal Sosiologi Pendidikan Dan Pendidikan IPS (SOSPENDIS)*, 2(2), 55–63.
- Khairunnisa, Y., Aulia, T., Ompusunggu, E. J., & Charisma, T. (2022). Peran Peran aktor Twitter pada gerakan tagar# unsubscribepodcastcorbuzier. *Jurnal Studi Komunikasi*, 6(3), 1041–1057.
- Krippendorff, K. (2022). *Content Analysis: An Introduction to Its Methodology*. <https://doi.org/https://doi.org/10.4135/9781071878781>
- Liu, B. (2012). *Sentiment analysis and opinion mining*. <https://doi.org/https://doi.org/10.1007/978-3-031-02145-9>
- Mancar, S. A. (2022). *Comparison of Inter-Rater Reliability Techniques in Performance-Based Assessment*. 9(2), 515–533.
- Maulana, A., Putra, E., Widyastuti, W., & Listiqowati, I. (2025). *Development of Rock Teaching Media for Strengthening Students ' Geoliteracy Skills in Geography Subjects*. 28(2), 246–256. <https://doi.org/10.20961/paedagogia.v28i2.102207>
- Meadows, M. E. (2020). Geography Education for Sustainable Development. *Geography and Sustainability*, 1(1), 88–92. <https://doi.org/10.1016/j.geosus.2020.02.001>
- Mulyani, H. S., Bakry, G. N., & Kusmayadi, I. M. (2022). Storytelling With Network Data Visualization Hashtag #Prayforturkey On Twitter. In *Why We Need the Journal of Interactive Advertising* (Vol. 10, Issue 10, pp. 349–383). https://doi.org/10.1163/_q3_SIM_00374
- Nisa', Z., Saputra, I. A., Rahmawati, R., & Putra, E. (2024). Development of Disaster Mitigation and Adaptation Learning Tools With Sets Vision (Science, Environment, Technology, Society) Geography Subject in SMA Negeri Palu. *Jurnal Geografika (Geografi Lingkungan Lahan Basah)*, 4(2), 78. <https://doi.org/10.20527/jgp.v4i2.8257>
- Novarita, A., Putra, E., & Maliki, R. Z. (2024). Identifying community liquefaction catastrophe preparedness in North Birobuli subdistrict, Central of Sulawesi. *IOP Conference Series: Earth and Environmental Science*, 1314(1). <https://doi.org/10.1088/1755-1315/1314/1/012034>
- Nugroho, W., & Prihatin, S. (2022). Penerapan Metode Simulasi Pada Praktik Penanganan Korban Bencana Sebagai Penguatan Ketrampilan Masyarakat. *Jurnal Pengabdian kepada Masyarakat*, 1(10)
- Nurhazizah, E., Ichsan, R. N., & Widiyanesti, S. (2022). Analisis Sentimen Dan Jaringan Sosial Pada Penyebaran Informasi Vaksinasi Di Twitter. *Swabumi*, 10(1), 24–35. <https://doi.org/10.31294/swabumi.v10i1.12474>
- Prasetyo, A., Effendi, M. M., & Dwi M, M. N. (2023). Analisis Gempa Bumi Di Indonesia Dengan Metode Clustering. *Bulletin of Information Technology (BIT)*, 4(3), 338–343. <https://doi.org/10.47065/bit.v4i3.820>
- Pratiwi, E. M., Gunawan, G., & Ermiana, I. (2022). Pengaruh Penggunaan Video Pembelajaran terhadap Pemahaman Konsep IPA Siswa. *Jurnal Ilmiah Profesi Pendidikan*, 7(2), 381–386. <https://doi.org/10.29303/jipp.v7i2.466>

- Putra, E. (2025). *Analysis the mitigation of floods in the junior high school students in Torue District : 21st-century learning skills Analysis the mitigation of floods in the junior high school students in Torue District : 21st-century learning skills*. <https://doi.org/10.1088/1755-1315/1462/1/012013>
- Rofiyanti, E., Agustina, D., & Firzah, M. (2023). *Analisis Peran Media Sosial sebagai Platform Komunikasi dan Penyebaran Informasi Kebencanaan di DKI Jakarta*. 6(2), 192–201.
- Rusydi, M., Efendi, R., Sandra, & Rahmawati. (2018). Earthquake Hazard Analysis Use Vs30 Data In Palu. *Journal of Physics: Conference Series*, 979, 012054. <https://doi.org/10.1088/1742-6596/979/1/012054>
- Salsabela, P., Zahroh, A., & Imroatus Sa, S. (2023). Peran Akun Twitter BNPB (@bnpb_indonesia) Dalam Penanggulangan Bencana Di Indonesia. *Prosiding Seminar Nasional*, 594–602.
- Samatan, N., Fatoni, A., & Murtiasih, S. (2020). Disaster Communication Patterns and Behaviors on Social Media: a Study Social Network #Banjir2020 on Twitter. *Humanities & Social Sciences Reviews*, 8(4), 27–36. <https://doi.org/10.18510/hssr.2020.844>
- Santi, I. N., Hatma, R., Mubaraq, R., & Wanti, S. (2022). *Pemanfaatan Media Sosial Sebagai Strategi Pemasaran bagi UMKM Kota Palu di Era Pandemi Covid-19*. 11(3), 647–654.
- Santoso, A. D. (2017). *Tweeting in Disaster Area : An Analysis of Tweets during 2016 Ma j or Floods in Indonesia*. 1(3), 178–188.
- Silviana, D., Geubrina Rizky, C., Sifa Shafira, N., Amaniyya, A., & Mawarpury, M. (2025). Resiliensi pascabencana: Eksplorasi pengalaman sosial dan emosional penyintas tsunami Aceh. *Jurnal Intensi: Integrasi Riset Psikologi*, 3(2), 35–49.
- Warastuti, W., Prayitno, H. J., & Rahmawati, L. E. (2025). Penerapan Literasi Digital dalam Membangun Kemampuan Berpikir Kritis Siswa di Sekolah Dasar. *Cetta: Jurnal Ilmu Pendidikan*, 8(2), 350–365. <https://doi.org/10.37329/cetta.v8i2.4143>