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Cognitive Approaches to Disaster Communication: Mass Media's Role in Tsunami Preparedness

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Abstract
Introduction: This study explored the role of mass media in enhancing tsunami preparedness among young adults on the southern coast of Central Java, a region highly vulnerability to tectonic events. Mass media, with its extensive reach and persuasive influence, played a significant role in disaster communication, shaping public awareness and preparedness.
Methods: Guided by Elaboration Likelihood Model (ELM) and neuroscience perspectives, the research examined how cognitive and emotional responses to disaster information influenced preparedness behaviors. A survey was conducted with 175 respondents aged 18-24 from Calaca, a high-risk tsunami zone. Among these, 91 respondents had prior disaster experience, with 60.38% relying on mass media as their primary source of emergency information.
Findings: The survey results showed that 74.9% of respondents indicated readiness for disaster preparedness. The study integrated the ELM framework with cognitive neuroscience, emphasizing modification to critical element such as ability to process information and the nature of cognitive processing. These adaptations supported more effective, persuasive disaster communication.
Originality: The finding underscored the potential of mass media as powerful stimulus, shaping cognitive responses and preparedness behavior. This research contributed to understanding the interplay between disaster communication, cognitive processes, and behavioral outcomes, offering insights for designing targeted interventions to enhance preparedness.
Keywords: Mass Media, Tsunami Preparedness, Disaster Communication, Elaboration Likelihood Model, Cognitive Process.

Introduction
Mass media plays a vital role in disaster management, especially in the context of tsunamis, in the Cilacap Area. As an area with high tsunami risk due to tectonic activity along the Indo-Australian plate, Cilacap requires a robust communication system. Mass media, such as radio, television and print media, are the main channels for delivering early warning information and evacuation guides. According to the agenda-setting theory, mass media significantly influences what issues the public perceives as important (McCombs & Shaw, 1972). Local radio such as LPPL Bercahaya FM is often relied on by the community because of its ability to reach remote areas quickly, event when

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telecommunication networks are disrupted. In addition, television such as TVRI Central Java and iNews TV provide real-time coverage of fields conditions, helping the community understand the current situation and prepare mitigation measures. These efforts align with the Uses and Gratification Theory (Katz et al., 1973), which suggests that audiences actively seek information that fulfills their need for safety and security during disasters.

The role of mass media is not only limited to disseminating information, but also educating the community about disaster preparedness. Through special programs, local and national media help raise public awareness of natural signs indicating a tsunami, the importance of evacuation routes, and self-rescue procedures. This is aligned with the Diffusion of Innovations Theory (Everett M. Rogers et al., 2014), which explains how media can facilitate the adoption of new behaviors, such as disaster preparedness practices, by providing clear and actionable information. Social media is also increasingly playing a role in accelerating the dissemination of emergency information, especially among the younger generation who actively use digital platforms. By combining factual news, emotional visuals, and practical guidance, the mass media contributed greatly to building the preparedness of the Cilacap community against the threat of tsunami. This approach reflects the framing theory (Entman, 1993), as media frames disaster narratives in ways that emphasize urgency and preparedness, guiding public perceptions and action.

The southern coast of Java, Indonesia, particularly areas like Cilacap, faces significant vulnerability to tsunami disasters due to tectonic activities along the Indo-Australian plate. This region tectonic profile, with historical earthquake-induced tsunamis in Banyuwangi (1994) and Cilacap (2006), has heightened the urgency for effective disaster communication (Sambah, 2019). Cilacap is one of the most tsunami-prone areas in Central Java, with a high-density population and numerous industrial facilities, making it imperative to establish robust communication systems to manage disaster risk and support community preparedness.

Effective disaster risk communication is critical informing communities about potential threats, recommended actions, and necessary precautions. Risk communication encompasses public or private communication that inform individuals about the existence, nature and severity of risk, ideally leading to increased awareness and preparedness (Doyle et al., 2019a). In region like Cilacap, where tsunami risk is high, the role of mass media is particulary important. Mass media, including television, radio and social media, has been identified as a primary source of disaster information, especially for younger demographics who rely heavily on digital communication channels (Lien, 2019). This study thus focuses on youth aged 18-24, who have experience with disaster events and are receptive to various forms of disaster communication through mass media (Purworini et al., 2019).

In disaster risk context, integrating a neuroscience perspective offers valuable insights into the cognitive and behavioral effects of disaster communication on communities. Cognitive neuroscience research shows that the human brain responds differently to information depending on the emotional and cognitive cues present in the message, impacting both immediate reaction and long-term behavioral changes. This understanding is especially relevant for disaster communication, where the goal is not only to capture attention but to foster retention of information and actionable preparedness. By analyzing brain responses, researchers can better understand how disaster-related messages activate areas of the brain associated with fear, memory, and decision making, such as the amygdala and prefrontal cortex, which are crucial in forming

attitudes and behaviors in response to risk (McNaughton & Corr, 2004). Consequently, neuroscience can help refine disaster messaging strategies to ensure that information is processed in a way that motivates appropriate, timely action.

In this study, the Elaboration Likelihood Model (ELM) is employed alongside neuroscience insights to examine how individuals process disaster information through the central and peripheral routes, either engaging with message deeply information through the central and peripheral routes, either engaging with messages deeply or reacting based on cues like emotion or visual elements (Richard, 1984). Neuroscience complements ELM by providing a more understanding of how these processing routes impact cognition and behavior. The peripheral routes, for instance, may leverage emotionally charged image that activate the brain's amygdala, leading to rapid awareness and readiness, whereas the central route may involve in-depth processing in the prefrontal cortex, contributing to long term attitude change and disaster preparedness.

Research suggests that young people in high-risk areas like Cilacap benefit from both formal and educational approaches to disaster preparedness (Rahman & Munadi, 2019). Formal education methods include schools-based programs, while informal channels involve mass media and social media, which can quickly disseminate warnings and critical information (Zander et al., 2022). Given the influence of both educational and media-based approaches, this study seeks to explore how combining ELM with neuroscience perspective can enhance the effectiveness of disaster messaging by tailoring communication to both cognitive and emotional processing pathways. This study ultimately aims to develop a more targeted disaster communication model that can foster both immediate and lasting preparedness among at-risk communities.

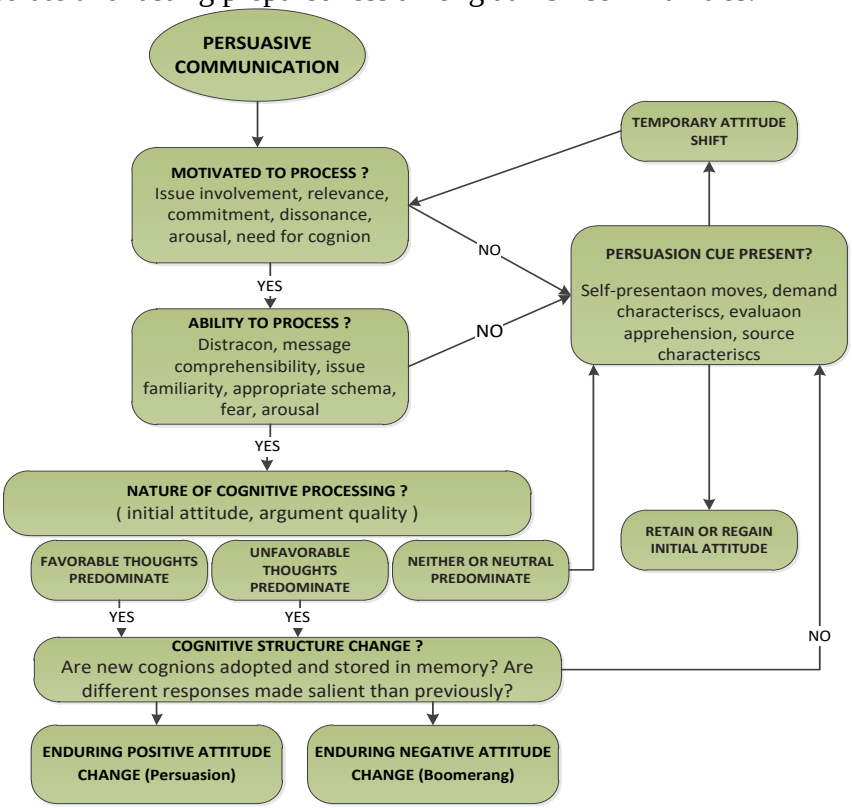

Figure 1. The basic Theory of ELM (source: Petty & Cacioppo, 1984; Kitchen et al., 2014)

This paper builds upon previous findings on ELM and neuroscience in risk

communication proposing an integrated approach that makes disaster information's more accessible, engaging, and persuasive for young audience. By aligning message delivery with cognitive processing needs, this research aims to develop a scalable disaster communication model that reduces uncertainty and strengthens community resilience against tsunamis.

Methods

This study used quantitative survey design to examine the influence of mass media in disaster preparedness attitudes and behaviors among young adults in Cilacap, a tsunami-prone area in Central Java Indonesia. The survey targeted respondents aged 18 to 23, a demographic chosen due to their significant role in disseminating disaster information and potential to act as a community change agent. A total of 175 respondents from high-risk tsunami sub-districts in Cilacap participated in the study. Participant were selected based on their residence in sub districts with documented high tsunami vulnerability. The selection criteria included individuals who had previous exposure to disaster events. This prior exposure helped ensure that respondents had a foundational understanding of disaster risk, providing e relevant context for assessing media influence on disaster preparedness.

The survey instrument was a structured questionnaire created on Google Form, consisting of 42 multiple-choice questions. Each question was crafted to align with Elaboration Likelihood Model (ELM), specifically targeting elements of both the central and peripheral processing routes. The ELM framework was chosen for its dual-route approach, which helps explain how individuals process persuasive messages either through deep cognitive engagement (central route) or via quicker, emotional responses (peripheral route). The data analyzed by spss version 22 with descriptive analysis procedure. The questionnaire indicators were formulating to assess the following key ELM constructs:

Table 1. Modified ELM Theory with Disaster Communication Media

ELM Theory in Disaster Communication	
Motivated to process	Question evaluated respondent level of engagement with disaster information and their willingness to seek information through mass media.
Ability to Process	Indicators measured respondent comprehension of disaster preparedness messages delivered through various media channels.
Nature of Cognitive processing	Respondents have knowledge of disaster response: early warning, earthquake response, evacuation response. Respondents have knowledge that their place of residence is a disaster-prone area. Items focused on the presence and influence of emotional or visual cues in media messages that might prompt immediate action or interest without deep cognitive engagement.
Cognitive Structure Change	This indicator assessed whether respondent exposure to disaster information led to long-term changes in attitudes and behaviors toward disaster preparedness.

Note: The questionnaire indicators were formulating to assess the key of ELM constructs.

Results

For researchers, disasters are full scientific data. There is a lot of data that shows vulnerability and future prediction. The existing data cannot be easily understood by the public (Doyle et al., 2019b). Scientist usually using complex vocabulary or technical knowledge (Aitsi-Selmi et al., 2016). Therefore, the mass media has an important role in disseminating information. The mass media also has a role to package information and persuasively. There are various media that can provide choices of disaster mitigation information, including printed media, electronic media, social media and even media through a direct delivery. Theoretically, there are four categories concerning the delivery of disaster messages through various media, namely: (1) informative messages, namely messages delivered in the closest period after a disaster occurs, (2) warning messages, namely warning of the secondary effects of a disaster, (3) consulting messages, namely actions and appropriate steps needed to take, and (4) guiding messages, namely instructions for recipients of the messages to take actions such as a guidance to evacuate, a guidance to go to health facilities and so on (Fokaefs & Sapountzaki, 2021).

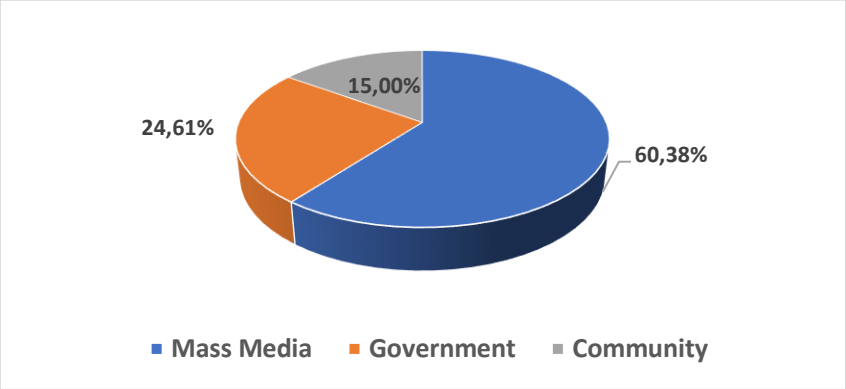

Figure 2. Message delivering media for tsunami disaster to motivate communities in the tsunami disaster mitigation in Cilacap Regency (source: Data processed by Researchers)

Based on the data above, 60, 38% of the public trust the information provided through the mass media, 24, 61% of the public trust socialization in their workplace from the relevant agencies, and 15% of them trust the information from social environments. The results of the study show that 60.38 % of respondents trusted the information provided through various media (Figure 2) (Arai, 2013). It is necessary to present vulnerabilities in natural disasters through interactive media. Mass media needs to be in visual form such as separate or combined maps (Doyle et al., 2019c). Intrinsic techniques in conveying persuasive messages use a combination of symbols which are modified using colors or provide some specific visual effects (Kubíček & Šašinka, 2011). Empirical studies conducted by Kubicek and Sasinka show that information emerging from gamba-image vulnerability maps drives serial processing because information must be stored in memory to make comparisons. This will provide faster decisions for message recipients and be accurate. In addition, it can also be responded more slowly, but it has accuracy in making decisions.

Disaster mitigation communication has been implemented by the Indonesian government from 2009 through the activities of disaster preparedness schools, which later developed into “disaster-safe schools”. This program is held formally in educational institutions and informally in communities with the support of stakeholders such as NGOs in the form of developing disaster management schools (Amri et al., 2017). Government develop community to increase awareness. Community as a natural environment to spread the information (Tagliacozzo & Magni, 2016). Communicating the disaster risk

involves 2 elements consist of (1) senders of the disaster risk information such as government, universities, or research institutions that have a lot of specific information on disaster preventions, and (2) recipients of the disaster risk information such as communities and individuals who have a lot of local information. Risk communication will be successful if three elements are well implemented, namely holistic learning, providing of facilities, and trust. Disaster risk communication will not run smoothly if there is a gap between senders and recipients so that a strategy is needed that includes disaster education and training of evacuation (Takeuchi et al., 2012). A tsunami disaster management model that must be communicated to communities intensively should include: (1) communicating a disaster mitigation by building the capacity of local communities, (2) preparing an action plan with local communities in the event of a tsunami disaster, (3) communicating traditional and modern early warning systems, (4) developing and communicating disaster preparedness srategies to local communities and tourists, and (5) developing partnerships with other stakeholders (Tolentino, 2007). Disaster mitigation communication is a management tool that serves multiple functions and purposes in increasing the awareness of risks and encouraging protective behaviors, and in providing warnings and triggering specific people's behavioral responses in the risk areas.

Disaster communication using various media and direct socialization will be effective in reducing public panic due to unclear information and in increasing public awareness about disasters that include awareness about basic knowledge, types of disasters, disaster-prone locations, disaster preparedness, disaster mitigation, emergency response period, rehabilitation, and reconstruction to minimize various potential risks of future disasters. Understanding of the effectiveness of communication can be achieved when messages are easily understood by the recipients using a clear, precise and complete verbal and nonverbal language that will give an impact to the recipients in the form of changes in attitudes and actions (Khumairoh et al., 2021). Results of this study show that respondents had tsunami knowledge (cognitive > 75%) but 92% of respondents were unable to explain the stages of disaster emergency response in their area when a tsunami occurs. An important aspect of the cognitive structure change in the ELM shows that 74.29% of respondents had knowledge and ability to prepare themselves in anticipating natural disasters, including in prioritizing risk groups (infants, children, pregnant women and mothers giving birth) in the medical treatment. Meanwhile, 25.72% of respondents were not prepared in terms of their capability in the medical field (Figure 3).

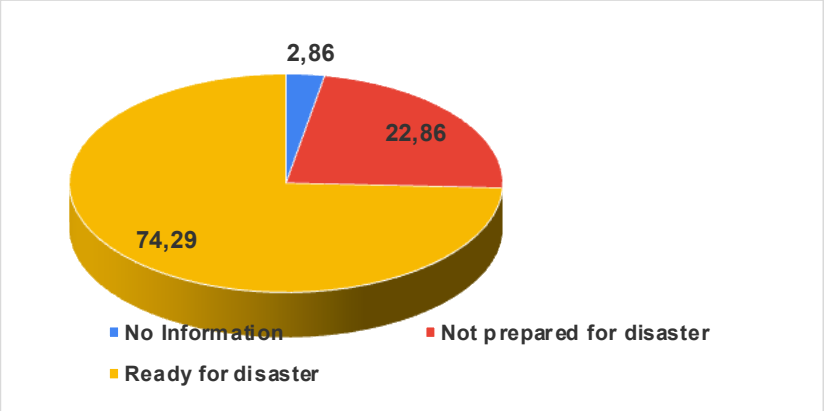

Figure 3. Awareness of Self Preparedness in Anticipating Natural Disasters Including in Saving Risk Groups (source: Data processed by Researchers)

The component of cognitive structure change is implemented through various disaster risk reductions and tsunami anticipation programs, in the form of distribution of information on tsunami-prone maps, disaster status maps, role-playing of disaster events and the formation of disaster-aware volunteers. Most of the respondents who lived in Cilacap stated that they had participated in disaster socialization (80.2%) and the first source of information related to disaster education communication was obtained from various mass media. This shows that health students had disaster awareness from socialization in their colleges and from mass media. Seeing from the involvement of respondents in the activities of socialization, role-playing of disaster events and in the formation of disaster-aware volunteers, there is a high awareness of disaster emergency response in the communities.

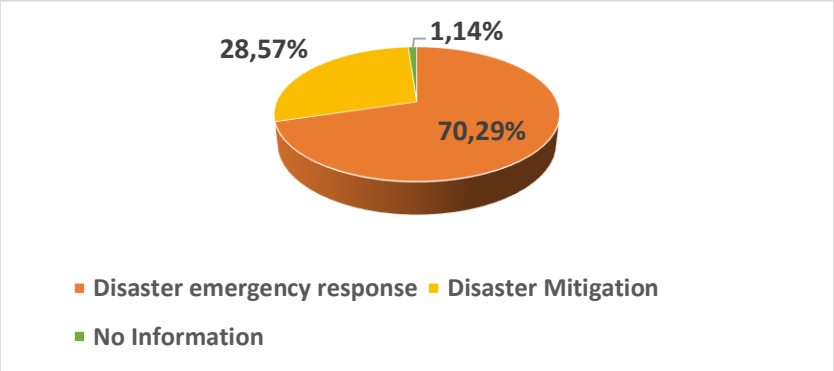

Figure 4. The easiness level of accesses obtained by the public to process information in the tsunami disaster mitigation in Cilacap Regency
(source: Data processed by Researchers)

Results of this study show that local communities had knowledge and awareness of tsunami disaster preparedness. The awareness in this context is the ability of all individuals to think, speak and act about tsunami risks in their area. The awareness is generated by the easiness obtained by the public to access information sources, which is influenced by culture, education and government policies. The data show that most public's knowledge comes from accessing electronic media and government information (Figure 4) (Istiyanto et al., 2012a). Communities in the study area obtained information from various digital media and from government, and they had a high awareness of the risk of a tsunami disaster in Cilacap Regency of Central Java, Indonesia. Local communities were prepared to face the tsunami disaster (Figure 5). However, the biggest problem is the lack of readiness of the tsunami early warning system that can effectively provide information quickly to local communities. In addition to the limited tsunami early warning system, there are no communication contact points in coastal areas that allow direct contact with government officials who are in charge of natural disaster mitigation (Istiyanto et al., 2012b).

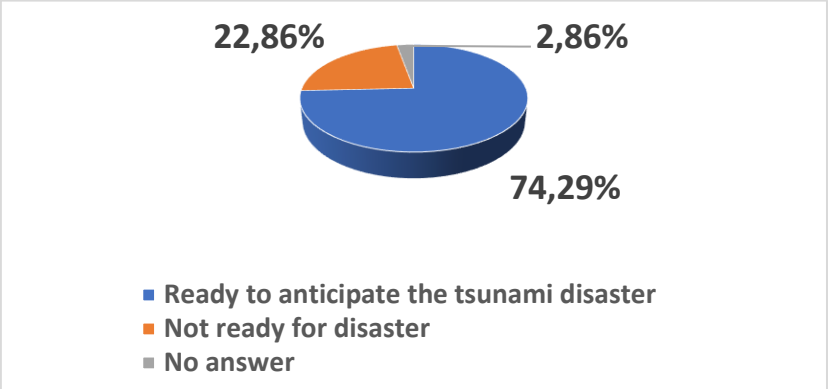

Figure 5. The readiness levels to assist to the government in the event of a tsunami disaster in Cilacap Regency (source: Data processed by Researchers)

The data above show that the sources of information that can be communication channels need to be reviewed in disaster communication. It is because each region has its own uniqueness on how it communicates with different communication target.

Discussion

Mass media plays a critical role in conveying scientific data to the public in a way that is easy to understand and relevant. One method that is oftens used is data visualization, such as graphs, infographics, and animations, which simplify complex concepts into more digestible information (Boy et al., 2014). In addition, culturally relevant narratives are often used to connect scientific data to the audience's everyday experiences, increasing engagement and understanding to managing disaster communication in managing vulnerabilities (Moorthy et al., 2018). Individuals from diverse socio-demographic and cultural backgrounds engage with scientific information and utilize it to inform their decision-making processes (Nisbet & Scheufele, 2009). Collaboration with scientist also helps ensure the accuracy of information and builds public trust in the content presented (Fischhoff & Scheufele, 2014).

However, there are significant differences in how educated and uneducated people receive scientific information. Individuals with higher levels of education tend to have better critical thinking skills, allowing them to analyze and evaluate information more effectively (Scheufele & Krause, 2019).They are also more likely to have aces to a wider range of information sources, broadening their understanding of scientific topics. In contrast, individuals with lower levels of education my struggle to understand technical terminology and abstract concepts, which can hinder their comprehension of the information presented (Nisbet & Scheufele, 2009).

The differences are also influenced by media and science literacy. Those with good media literacy are better able to assess the credibility of information sources and understand the context of the data presented (Vraga & Bode, 2020). In contrast, individuals with low media literacy are more susceptible to misinformation and misinterpretation. Therefore, the media has a responsibility to present information in an inclusive manner, taking into account variations in the education and literacy levels of their audiences. The implementation on disaster education initiatives in Cilacap demonstrates significant efficacy, particularly as disaster literacy has been systematically integrated into the school curriculum support by local government. This integration ensures that foundational knowledge about disaster preparedness is imparted at an early age, fostering a culture of resilience within the community. The impact of these efforts is further amplified by the substantial exposure to media engagement creates a

comprehensive approach to disaster preparedness, enabling both cognitive understanding and actionable behaviors among the populace.

To bridge this gap, the media can adopt an audience-centered communication approach, such as using simple language, providing relevant context, and utilizing a variety of information delivery formats to meet different preference. The media can increase public understanding and engagement with scientific information, ultimately leading to greater participation in science-based discussions, and decisions. The majority of the articles have focused on climate communication for adaptation, with considerable attention also given to framing, risk perception, and mitigation strategies (Ceyhan & Saribas, 2022).

The study results reveal a high awareness level among respondents in Cilacap regarding disaster preparedness, with 74,29% of them indicating readiness to anticipate natural disasters. This high preparedness level reflects both cognitive engagement and attitudinal change, likely influenced by the dual processing routes of Elaboration Likelihood Model (ELM). Given that 60,38% of respondents reported trusting information provided by mass media, it is evident that media channels significantly impact the central and peripheral cognitive processing routes. This engagement reflects the efficacy of mass media in both capturing immediate attention through emotionally charged content and fostering deeper, information-based engagement.

Mass media frequently employs the peripheral route by presenting visually impactful and emotionally charged headlines such as 'Tsunami Alert' or '10-Metres Tsunami Potential.' Such headlines evoke an immediate response by activating the amygdala, a brain region responsible for processing emotions like fear and anxiety. The emotional engagement aligns with ELM's peripheral route processing, which relies on quick, emotion-driven judgments rather than detailed analysis. Neuroscientific studies support that emotionally charged imagery and language can effectively motivate swift responses, particularly in emergency contexts where individuals need to act rapidly without extensive cognitive deliberation (LeDoux, 2000a). In this study, the peripheral approach seems effective in creating an initial awareness, as seen in the respondent high recognition and response readiness to potential tsunami threats.

Targets the central route of processing, mass media in Cilacap also incorporates logical explanations, scientific data, and practical guidance for evacuation. The study highlights 32% of respondent initially obtained disaster information through structured programs at educational institution, supporting the use if fact-based media for audiences capable of deeper cognitive processing. The central route of ELM is characterized by rational engagement and systematic evaluation of information, which requires audience motivation and cognitive ability. In this context, students with exact science backgrounds demonstrated higher readiness and knowledge retention, suggesting that information-rich content effectively engages this demographic. Such processing involves the prefrontal cortex, a brain region responsible for rational decision-making, which, when activated, support long-term memory formation and lasting behavioral changes essential for disaster preparedness.

Interestingly, repeated exposure to disaster information has reinforced memory retention and preparedness behavior among Cilacap youth. Cognitive neuroscience indicates that repeated messaging can transition individuals from peripheral to the central processing route, as repeated exposure strengthens neural pathways associated with memory retention (Oberauer, 2019). In this study, repeated engagement through mass media, socialization in schools, and direct socialization methods has likely contributed to

the high preparedness rate observed in respondents. For example, those exposed to disaster role-play exercise and information session showed increased engagement with evacuation protocols and risk awareness, reflecting a shift toward central route processing where information is not only acknowledged but also integrated into long-term cognitive structures.

The use of various formats, including visual stimuli in print and online platform, enhances the accessibility and attractiveness of disaster information, addressing different cognitive needs across audience. According to the survey, a significant portion of respondent (81,71%) preferred watching disaster preparedness videos or advertisements, which effectively combine visual and auditory cues to solidify understanding and recall. Visuals, such as illustration of high waves of evacuation routes, are known to strengthen retention through associative memory aligning with ELM's model of attitude change when cognition is actively engaged by appealing and relevant content.

Cognitive Perspective on how Mass Media Influence the Brain and Behavior in Disaster Communication

1. Cognitive and Emotional Response to Disaster Information

Cognitive neuroscience has demonstrated that emotionally changed disaster warnings activate the amygdala, a brain region critical for processing fear and anxiety (LeDoux, 2000b). Media often employs compelling images and urgent language, such as 'Tsunami Alert,' to capture attention and elicit rapid responses from the public (Lang & Davis, 2006). Neuroscience provides valuable insights into how human brain processes, interprets and responds to information from mass media, especially information related to risk and disaster. Understanding these mechanisms in critical for disaster preparedness and preventive actions. Below is a discussion on how mass media influences the brain and behavior in disaster contexts, integrating insights from Elaboration Likelihood Model (ELM). Such immediate reaction is essential in disaster scenarios, as they can motivate swift preparedness behavior.

2. Deep Information processing and Attitude Change (Central Route Processing)

In contrast, the ELM's central route involves deliberate analysis of message content. When media provides detailed explanations-such as scientific data or tsunamis or clear evacuation protocols-it engages the prefrontal cortex, responsible for rational decision making (Miller & Cohen, 2001). This thorough processing fosters enduring attitude changes, integrating new information into existing cognitive structures and enhancing long term preparedness intentions (Petty & Briñol, 2008). Studies suggest that when individuals engage deeply with logical, fact-based information, their behavior is more likely to align with sustained disaster preparedness (Gould et al., 2014).

3. Repetition and Long-term Memory Formation

Repeated exposure to information strengthens neural pathways, enhancing long-term memory retention. In disaster communication, repeated exposure to warning messages via mass media can help solidify knowledge about disaster preparedness, contributing to a heightened state of readiness. Repetition is the key to forming long-term memories by indicating that repeated exposure can shift people from peripheral to central processing over time (Petty & Cacioppo, 1986). In other words, frequent, consistent messaging can help individuals internalize knowledge, making it accessible when a disaster occurs.

4. Emotional Cues as Peripheral Processing Triggers

Media often uses emotional cues, like disaster visuals, urgent tones, or sirens-to quickly capture audience attention. Neuroscience has shown that emotional triggers active

the brain's limbic system, such as governs rapid, emotionally driven responses. In the ELM framework that can influence behavior without deep cognitive processing. Such cues are particularly useful in disaster contexts where swift action is required. Media can employ emotional visuals or sounds to alert the public and encourage immediate disaster preparedness.

5. Lasting Attitude and Cognitive structure Change

In addition to immediate responses, media messages about disasters can contribute to lasting changes in attitudes and knowledge structures, it suggests that message processed via the central route are more likely to be stored in long-term memory, leading to durable behavioral changes (Petty & Briñol, 2008). According to ELM, enduring attitude change is achieved when individuals actively process message that are relevant and well supports by facts. Mass media, by providing educational content preparedness, can promote a mindset shift that encourages ongoing readiness (Sherman).

6. Influence of Media Framing on Risk Perceptional

Mass media's framing of disaster messages can shape how individuals perceive and asses risk, a phenomenon explained by both neuroscience and ELM. Positive or negative framing affect cognitive biases and emotional responses in the brain, influencing how seriously people consider risks (Tversky & Kahneman, 1981). For instance, headlines like 'Tsunami Alerts!' this will drive disaster preparedness efforts preparedness behaviors. In summary the study results underscore the importance of dual-route communication strategy in disaster preparedness, which leverages both emotional and logical content to engage audience across cognitive levels.

Meanwhile, this study presents some limitations that could guide future research direction in disaster communication. *First*, a potential limitation lies in the sample representation, as the study focuses specifically on young adults aged 18-23 in Cilacap. While this demographic is significant for understanding disaster communication, limiting the sample to this age group in a specific region restricts the generalizability of the findings to other groups or regions with different socio-cultural context. Future research could expand the demographic scope to include a broader age range, education and varying socio-economic backgrounds, which would allow for more comprehensive insights into how diverse groups process disaster information. Another limitation is the geographic focus on Cilacap, Central Java, known for high tsunami risk, which may limit the applicability of findings to other regions facing different disaster types, such as floods or volcanic eruptions that might require different communication strategies. Comparative studies across diverse geographical areas and disaster types could help reveal whether the effectiveness of ELM-based communication varies by region and disaster type.

The study also lacks longitudinal data, as it captures responses at the single point in time, which insights into how cultural backgrounds influence the effectiveness of ELM in disaster communication, as cultural differences may lead to varied cognitive and emotional responses to disaster messaging. Additionally, testing different media channels (example: social media, television, radio, print) could identify the most effective communication mix for diverse audience. In the communication strategy include how to persuade people to change their attitude. Incorporating applied cognitive neuroscience into disaster communication could also help researcher determine the optimal design of message. For instance, understanding how people with different levels of disaster experience or preparedness respond neurologically to warning signals could lead to more targeted messaging strategies. Applying cognitive neuroscience to the future disaster communication is a promising direction. By examining brain responses through

techniques like cognitive task combine with neuroscience tools (example: eye-tracking, EEG, etcetera), researchers could observe which parts of the brain activate in response to different media cues, such as emotional imagery or urgent language. This approach would allow for a more precise understanding of how disaster messaging engages cognitive and emotional pathways, including those central and peripheral routes describes in the Elaboration Likelihood Model.

Conclusion

By utilizing both routes of processing as explained in the ELM, mass media can effectively influence the brain and behavior in disaster communication context. Peripheral route processing helps mass media attract immediate attention through emotional cause, while central route processing supports deeper cognitive engagement that can lead to lasting knowledge and preparedness. This combination ensures that disaster messages from the media not only grab public attention but also foster long-term attitudes and actions, enhancing community resilience in the face of the future disasters. The results of this study show that 60.38% of respondents preferred mass media to other methods such as direct communication in providing information. National media and local media have an interest in disseminating information related to the Tsunami disaster. Mass media which is now transformed into a convergent media runs in two ways, namely conventional and digital. The cognitive structure change aspect of the ELM shows that 74.29% of respondents had the knowledge and ability to prepare themselves in anticipating natural disasters which includes in saving risk groups. Mass media has an important role in disseminating information. Collaboration between mass media, government and communities builds disaster-conscious community entities. The component of cognitive structure change is implemented through various disaster risk reduction and tsunami anticipation programs, in the form of distribution of information regarding tsunami-prone maps, disaster status maps, role-playing of disaster events and the formation of disaster-aware volunteers.

Conflict of Interest

We certify that there is no conflict of interest with any financial, personal, or other relationships with other people or organization related to the material discussed in the manuscript.

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