IDRiM (2025) 15 (1) ISSN: 2185-8322
DOI10.5595/001c.140724

Journal of Integrated Disaster Risk Management

Regular Article

# Comparative Analysis of Response to "Ametore," a Disaster Scenario Experience Tool: Case Study of Pichucalco in Mexico and Nakajima in Japan

**Kensuke Takenouchi[1*], Rodrigo Garibay Rubio[2], Mao Ishizaka[1], Genta Nakano[2] and Katsuya Yamori[2]**

Received: 06/10/2024 / Accepted: 20/04/2025 / Published online: 13/06/2025

**Abstract** Delays in disaster response to intensifying climate change-related weather events continue to be a major challenge. In light of this situation, the authors have developed Ametore, a multi-user tool, which simulates disaster scenarios to confirm and discuss when and how to respond to disasters. The authors compare cases of Ametore training in Japan and Mexico for residents and students to examine the differences in disaster response between the two countries and the effect of using Ametore on improving disaster responses. In all cases, the percentage of safety-oriented actions increased as disaster risk probability increased. In the cases of Japan, the proportion of safety-oriented actions increased in the second trial, and the timing of taking safety-oriented actions occurred earlier. In Mexico, the percentage of safety-oriented actions decreased, and the timing of actions began just before a disaster occurred. Evidently, the effects of Ametore differ depending on the local social environment and attitudes toward disasters between the two study sites. In Japan, the use of a rich variety of disaster risk information is encouraged and the public can relatively easily access the information. In Mexico, basic data, such as observed meteorological data, are the main source of information. Therefore, awareness of disaster information is dependent on the individual, and the public awareness has seemingly not advanced sufficiently to stimulate action through disaster information.

**Keywords:** risk communication, scenario experience, comparative analysis, Japan, Mexico

[1] Faculty of Engineering and Design, Kagawa University, Japan
[2] Disaster Prevention Research Institute, Kyoto University, Japan
* Corresponding author email: takenouchi.kensuke@kagawa-u.ac.jp

# 1. INTRODUCTION

Climate change has intensified weather-related disasters and their impacts; while the number of deaths from weather-related disasters has dropped by almost one-third since 1970, the number of disasters increased five-fold between 1970 and 2019, and, with it, economic losses have also increased (World Meteorological Organization, 2021). The probability of significant weather events occurring in the future is expected to increase, which was once unlikely based on previous statistical data.

There exist various simulation-based policies and tools to reduce disaster risks (Solinska-Nowak et al., 2018), and these policies and tools, such as hazard maps (Tokyo metropolitan Foundation Tsunagari, 2025), are based on certain assumptions (Japan International Cooperation Agency, 2021). Such simulations remain insufficient for responding to real disasters. General hazard maps contain static information, and it is difficult to observe changes over time. In response, experts have conducted multi-model ensemble climate change simulations for use across various fields (e.g., Wilcke and Bärring, 2016). In Japan, this system provides the results of d4PDF (database for policy decision making for future climate change) regional ensemble forecasts with a horizontal resolution of 5 km (Kawase et al., 2023). While such simulation results are more effective if the conditions and methods are set appropriately, their use is limited to specialized institutions and interests.

Several attempts have been made to use simulation-based activities and tools for disaster risk reduction and disaster management planning to improve disaster awareness in society. The most common tool is the “hazard map,” constructed based on simulation results. However, we believe that the information provided by hazard maps is not sufficient to deliver a significant educational experience. Owing to the static nature of the information provided in a hazard map, it is difficult for the user to evaluate changes over time, making it difficult for individuals to prepare for unprecedented disasters; for example, low evacuation rates have long been an issue in Japan. Properly identifying disaster risk and taking timely action may be even greater challenges in the era of climate change.

Under the outlined circumstances, Ametore (“Ame” meaning rain, and “Tore,” an abbreviation of training; see Takenouchi et al. (2021)) was developed as a tool for constructing simulated disaster scenarios using various simulation results and experiencing them on the web. This tool provides an opportunity for participants to examine what actions they would choose to take in real time as the situation evolved, allowing us to understand the timing and content of the appropriate disaster response. Through a comparative verification of simulated disaster experiences using Ametore in Japan and Mexico research fields, we discuss the differences in disaster response between the results from the two countries and the effectiveness of Ametore in improving disaster response. The reason for choosing these two countries is the similarity in terms of disasters experiences. Figure 1 shows a comparison of the number of deaths related to weather-related natural disasters (2000–2023) based on EM-DAT data. The results are similar, with 2,965 deaths in Japan and 1,971 deaths in Mexico, except for a large number of deaths owing to extreme temperatures in Japan. In addition, the populations of Japan and Mexico were approximately the same in 2023 at approximately 120 million people according to data from the Population Division in the United Nations. Although not meteorological disasters, Japan and Mexico have the same high incidences of earthquakes and volcanic disasters. On the other hand, there are likely to be differences among countries in terms of disaster awareness and institutionalized prevention and response systems. Considering Japanese and Mexican societies have the different characteristics in terms of social cohesion, risk literacy and preparedness behaviors, it is important to highlight the significance of this study in identifying common issues in disaster behaviors under different sociocultural contexts.

In this study, Section 2 reviews related researches on the timing and action during a disaster and international comparison of disaster response, and Section 3 explains what Ametore is, the research field, and the Ametore settings used in each field. Section 4 compares the results of the case in two countries based on the results of disaster responses in Ametore, questionnaires, and various field background. Section 5 considers the characteristics and the differences in disaster responses and disaster information between the cases in two countries based on the results, and Section 6 provides a summary.

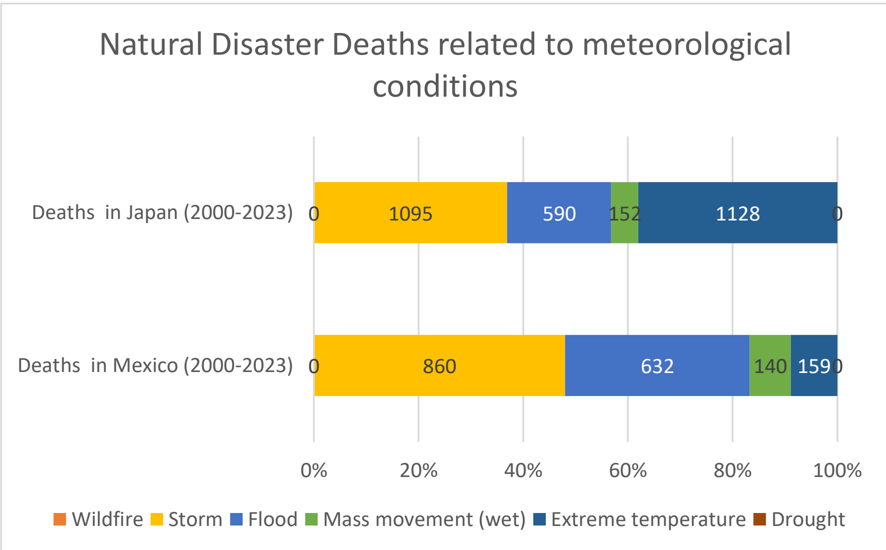


**Figure 1.** Natural disaster deaths related to meteorological conditions
Note. *This figure was made by the author using EM-DAT data (EM-DAT, 2025) for climatological, geophysical, hydrological, and meteorological disasters in the Natural Disaster category.

## 2. LITERATURE REVIEW

### 2.1 Timing and Action During a Disaster Scenario

A key feature of Ametore is that the participants discuss the content of actions and their timing while experiencing the simulated scenario such as “When and how will I act?”. Although there have been various discussions on time in disaster response, especially in the case of weather-related disasters as shown in the following literatures, “Time” is a critical factor in disaster response and action, particularly for weather-related events, as delays in evacuation can lead to casualties.

Sorensen (1991) noted that the time spent gathering families and resources and actually evacuating is often varied, and modeling the timing of actions during a disaster is a very complex process. Indeed, efficient and timely evacuation is an important concern; the decision of households to evacuate and stay, and their choice of departure time, are complex phenomena, as indicated by Sarwar et al.’s (2018) study of disaster response during Hurricane Ivan that struck Cape Verde in 2004. Short lead times (Chen & Wu, 2014), variations in evacuation times (Sorensen, 1991), and the paradox of risk perception (Wachinger et al., 2013) are all issues pertaining to the timing of actions in actual disaster scenarios. Gauging the proper response may even be necessary to focus on uncertainty of severity and multifaceted nature of disasters as mentioned in Yore and Walker (2020), and, often, individual characteristics (Hidaka et al., 2024) and social contexts (McLennan et al., 2019) play a significant role in such discussions.

Regarding factors influencing the timing of actions during disasters, Lindell et al. (2018) discussed departure times from the perspective of the decision times of authorities, warning reception times of households, and evacuation preparation times of households. Hasan et al. (2013) noted the presence of normal travel time to reach a destination, household location, and number of children as random parameters in evacuation timing. Based on the literature on hurricane evacuation, Pham et al. (2020) found less certainty in terms of the behavioral drivers that influence the variability in hurricane evacuation departure times in much of the hurricane evacuation literature; they examined the influencing variables, spatial-temporal differences, interactions with other factors, and their influences on action for the case of the 2016 Hurricane Matthew, and summarized the characteristics of evacuation departure times. Lindell et al. (2005) replicated prior findings on the timing of evacuation decisions to show that new information and household characteristics relating to evacuation readiness times were not correlated with evacuation decision times. Thiede and Brown’s (2013) analysis of the 2005 Hurricane Katrina response revealed that post-disaster discussions about race or “color of disaster” are primarily related to evacuation; that is, race and socioeconomic status influence evacuation outcomes and possibilities. Scholars have extensively studied the factors influencing the timing of action during disasters such as volcanic eruptions (Lim et al., 2022), storm surges (Pan, 2020), and evacuations from high-rise buildings (Choi & Do, 2019), and these studies have guided the development of evacuation models.

Evacuation models lay the groundwork for a more realistic representation of human factors (Wang et al., 2021) and ensure the adequacy of the evacuation infrastructure, decision-making processes, and safety. Gehlot et al. (2019) modeled the relationship between evacuation departure time and travel time for the 2012 Hurricane Sandy. Naismith et al. (2024) studied four volcanic eruption events in Fuego, Guatemala, to examine evacuation models; they related the timescale of the volcanic hazard to the timescale of evacuation action based on a narrative analysis involving interviews. They find that the special procedures related to the responsibility for evacuation in Fuego are unique in that they are the subject of discussion.

These studies can provide useful insights for modeling disaster responses. In this study, too, the timing of action during a disaster is one of the main points of discussion, and it is useful for evaluating the natural and social scientific aspects of what kind of discussion is possible compared to past studies.

In fact, the timing of actions during disasters is often empirically evaluated in terms of influencing factors and modeling. Some take a narrative approach, such as Naismith et al. (2024), while others take a systemic approach, such as Wang et al. (2021) and Gehlot et al. (2019). While it is also true that, during an actual disaster, some individual factors only exist in a particular situation, environment, and time, we propose that those particular factors can be added to the commonly shared features, and it is this blend that can improve usefulness of scenario experience and proper diversity of disaster response. This research, which uses Ametore, is designed for individual or organizational participation, but it also accounts for the geographical and social environmental aspects of the individual. That is, for an experience of the same event, the shared timing of actions during a disaster vary by each participant and deepens mutual understanding.

This means that the simulated disaster experience through Ametore has aspects of experiential learning approaches (Kolb, 2014). The discussion of scenario-based learning is important for advancing the people-centered approach that is feasible in the Sendai Framework (UNDRR, 2015). In addition, regarding simulations in this type of scenario-based learning, Kleiboer (1997) stated that there were five functions: a research tool; a teaching and training instrument; a planning method; a tool for designing decision support systems; and a personnel selection method, and Ametore is particularly targeted at the teaching and training instrument in them. Several games have actually been developed as scenario experiences for the purpose of teaching and training instrument. The Felicio et al. (2014) and Tsai et al. (2019) discussed games for protecting towns from disaster scenarios, and Mossoux et al. (2016) developed a board game aimed at raising awareness of geohazards and disaster risk reduction strategies. "Nige-tore" in Yamori and Sugiyama (2020) is also a scenario-based game that links tsunami simulations with actual evacuation behavior on a map. Other examples include simulated flood drills based on scenarios (Practical Action, 2018). On the other hand, Ferdinandus et al. (2013) pointed out that it was simply not feasible to create personalized scenarios on a large scale. This study also focuses on behavioral change through Ametore, and the educational effectiveness of experiential learning can also be an important evaluation axis.

IDRiM (2025) 15 (1) ISSN: 2185-8322
DOI10.5595/001c.140724

## 2.2 International Comparison of Disaster Response

In comparing disaster response in the cases of Japan and Mexico, researches on international comparisons of disaster response is a useful reference. Most international comparisons in the field of disaster risk reduction deal with administrative crisis management and policies. While there are many studies of disaster response in each event, there are few studies that compare their results. This may be partly because the occurrence of disasters varies so much by country, and, thus, inevitably entails differences in social and cultural characteristics. Naturally, even with the same external force of a natural hazard, the results of the disaster differ depending on resilience capacity, level of disaster awareness, etc. Nevertheless, the studies that enroll themselves in cross-cultural equivalence have greatly contributed to our understanding. In some cases, international comparisons can reveal characteristics that would be difficult to see on their own. Paton et al. (2010) found that cross-cultural equivalence in factors that predict the adoption of hazard preparedness measures (in this case, earthquakes) can help us make cost-effective resources available to countries and communities that lack the resources to do so. In a later study, Paton et al. (2013) compared data from a combination of hazards and countries (earthquakes in New Zealand, Japan, and Taiwan; volcanoes in New Zealand, Japan, and Indonesia) to analyze whether models can explain differences in preparedness levels across cultures. The evidence suggests that international comparisons of disaster responses must focus on both equivalence and heterogeneity.

Among studies comparing disaster responses, Izumi and Shaw (2022) used a questionnaire survey to compare the disaster response and impact of COVID-19 to the 2020 Cyclone Amphan in India, the 2020 Kumamoto floods in Japan, the 2020 Typhoon Lolly in the Philippines, and the 2020 California wildfires in the U.S. They find clear differences in perceptions and impacts on individual disaster response, such as evacuation, across countries. Appleby-Arnold (2021) compared disaster awareness and response through discussions at a citizens' summit between Romanian and Maltese citizens, who have very different experiences of disasters, as high- and low-risk places with diametrically opposed "disaster histories." While Malta revealed a shift in community cohesion from personal to cultural values, Romania highlighted the ambivalence between trusting behavior as a cultural norm and distrusting authority based on experience and unfulfilled expectations, with a marked manifestation of national cultural characteristics. Räsänen et al. (2020) compared the different concepts of the community itself in discussing disaster response. They compared flood and storm risk management in Finland, wildfire risk management in Norway, and volcanic risk management in Iceland by focusing on place-based community, interaction-based community, and community of practice and concern, and found the existence of community resilience. They argue that resilience depends on how communities are conceptualized and operationalized.

Some studies make institutional comparisons between countries: Shakeri et al. (2021) examined, compared, and analyzed the legal and institutional frameworks of disaster management systems in India and Nigeria. They also compared communities, showing that, while Nigeria does not have a section dealing with discussions such as community participation, India recognizes the role of community groups, youth organizations, or other volunteer organizations in all disaster response activities. Malešič (2020) posed the question "Is the implementation of an Incident Command System an appropriate solution for Slovenia, where the intensity of disasters is relatively low and the disaster response system is less complex than in other countries?" The success of such a system is higher when the members who use it belong to the community, when disasters are routine, and when the emergence of social and cultural situations is at a minimum (Buck et al., 2006). This is not the case in Slovenia, where some communities may develop "local customs" and perceive the new system as being imposed from outside. Al Kurdi (2021) conducted a comprehensive systematic comparative literature review of disaster management in Qatar, Oman, Jordan, Egypt, and Morocco. Although not directly targeting disaster response, they confirm that disaster policies differ even in neighboring land-locked countries, and that social and cultural barriers compromise community engagement and advance planning for emergency preparedness. Paterson and Charles (2019) identified how academic discussions in local communities take place worldwide, covering 188 articles providing information from 318 communities. They nevertheless do not compare specific response actions such as evacuation.

In international comparisons of disaster responses in the past, there are many cases where the characteristics of these responses are extracted and discussed from several perspectives. What we understand from the past literature is that international comparisons of disaster responses are not adequately discussed, partly because of the large social and cultural factors underlying the characteristics of disasters and disaster victims, and the lack of a platform that allows discussions in the same format.

In this study, too, while preparing the same environment of simulated experience through the same platform in Ametore, but using local available information and warning systems operating though real case retrieval, we look to maximize environmental and response systems consistency of each country's actual characteristics reflected in the disaster scenario, extracting and comparing the characteristics of both in terms of the content and timing of disaster responses. However, Ametore can play an important role in comparing differences on the same platform. Thanks to the content flexibility features of Ametore, it allows the integration of individual characteristics of the culture and the scenario while also creating a standard structure that could be used cross-culturally for disaster risk reduction study. As a result, we believe that the method in this study can contribute to understanding the cultural and social factors behind disaster decision-making.

## 3. METHODS

### 3.1 Research Objectives and Flow

We conducted a comparative study of simulated disaster experiences using Ametore in research fields of Japan and Mexico based on the results of action selection and questionnaire surveys. In addition, considering the background of the differences in hazard frequency, social characteristics, environment, and disaster information systems in each case, we discuss their differences in disaster response and the observed changes through the Ametore trainings.

For our comparative analysis, we first compared the content and timing of actions taken in simulated disaster scenarios using Ametore in Japan and Mexico. For Japan, we refer to two cases from Takenouchi et al. (2021), and for Mexico, we use the results of two cases conducted in Pichucalco, Chiapas in 2023. The results of the questionnaire are also compared to analyze the differences in the responses to Ametore in the cases of both the countries. The results form our foundation to further explore the differences in the effects of Ametore and the underlying reasons. Note that each region has different disaster characteristics, and the social environment for disaster risk reduction differs significantly as well. As a result, the same disaster scenario lacks realism and remains a fictional discussion. Therefore, in this study, we thus avoid a comparative discussion based on the same scenario; instead we compare similarities and differences of each case study while accounting for regional heterogeneity. Although it is difficult to compare disaster responses themselves, it is possible to get a glimpse of the homogeneity and heterogeneity of disaster response characteristics while reflecting the actual characteristics of the local disaster in both regional settings.

The following 3.2 describes Ametore used in this study in detail, and 3.3 shows the experimental settings, such as the research field, Ametore scenarios, and questionnaire contents.

### 3.2 Ametore, A Simulated Disaster Experience Platform

Ametore is a tool that aids in the exercise and review of disaster responses by linking disaster simulations and responses by various participating entities (Takenouchi et al., 2021). The “exercise of disaster response” is the process of confirming and implementing response actions before a disaster occurs, and the “review of disaster response” is the process of evaluating and reviewing the response actions taken by the participants after the first trial. To improve disaster response, people think from a retrospective perspective, discussing when and how they should have acted after a disaster, or on the assumption that a disaster will occur. In the case of an actual disaster, a prospective perspective is used to prepare for disasters that may or may not occur in the future. Even when the same disaster phenomenon is targeted, these two perspectives differ completely. Both perspectives need to be evaluated for improvement in disaster response. In Ametore, participants consider their actions in a scenario where they don't know what will happen next, and then reflect on their actions again after the scenario has ended. It is important to think retrospectively in response to the actions based on the prospective thinking at the time, such as, “At that time, I didn't think of any other way to act this way, but that would still result in a disaster.”

Figure 2 shows the conceptual framework of Ametore and Figure 3 shows an actual screen image of the tool. Ametore emphasizes the functions of "sense of reality," "timing of action," and "simultaneity." To enhance the sense of reality, text and image information can be presented at any time in accordance with changes in the situation based on the simulation results, so that a situation close to reality can be reproduced (various types of information can be presented at any time). Various hazards can be considered as disaster phenomena, such as the most experienced phenomenon, hypothetical intensification of rainfall intensity in the past, earthquake magnitude, and examples of disasters in other regions. The system was made flexible such that any hazard can be used in the training according to the participants (any hazard could be set).

To confirm the timing of action for each participant, the training is designed to allow each participant to first experience the disaster response in their own way, and then review it with reference to the opinions of other participants (after exercising it, the participant can review it again).

For simultaneity, the training is conducted in the same manner as an actual disaster, with no backtracking or the passage of time progressing automatically (in the present tense). In the real world, including during a disaster, it is impossible to return on time and change one's actions. The objective is to form a real-time feeling of "I couldn't do anything when I realized it."

Ametore is aimed at understanding the appropriate scenario through a simulation, while allowing participants to share disaster response information through communication, which facilitates a change of awareness and discussion. It also allows us to statistically or narratively evaluate the reactions to the scenarios, providing an environment for exploratory and experimental approaches in theoretical and applied research.

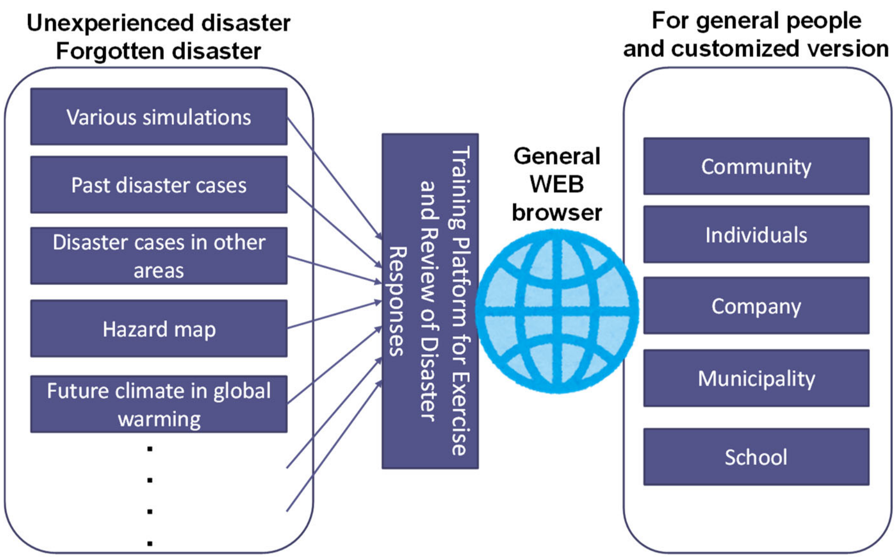


**Figure 2.** Conceptual framework of Ametore, a disaster response simulation tool

DOI10.5595/001c.140724

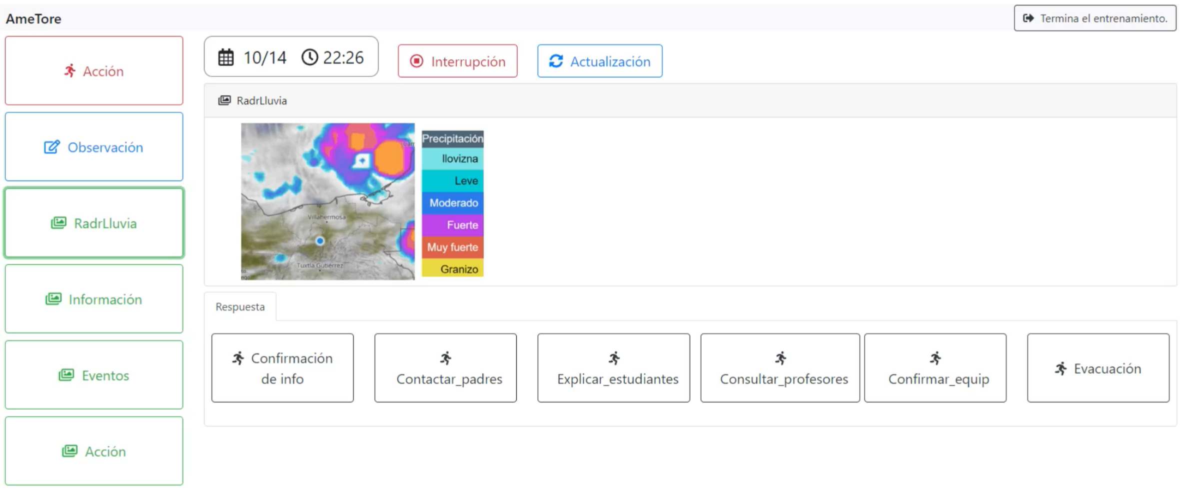


**Figure 3.** Display of the Ametore tool in action

### 3.3 Research and Experimental Settings

We focus on two cases from each of Japan and Mexico including both students and residents. Table 1 lists the characteristics of each field and settings of the Ametore. Each case study was located in areas at risk of river flooding and landslides; however, the scenarios were created in consideration of the local characteristics of each area as well. This study does not strictly evaluate the impact of the different scenarios but offers a comparative analysis focusing on the characteristics of the manifestation of action choices in each case.

In each experiment, the participants are first given instructions on how to record their choices of disaster responses on paper at what point in time with watching a video of a disaster scenario. In this study, we did not use the Ametore website, but instead created videos using Ametore. This was because the case study in Japan was a preliminary test for web development, and in the case of Mexico, the internet environment was not sufficient. After filling in the form, each participant puts stickers on a poster-sized sheet of paper showing a cross table composed of time and actions, and the participants checked the sheets with stickers.

Cases in Japan were based on a disaster risk reduction workshop held every year in Nakajima School District, Ise City, Mie Prefecture in cooperation with the local community and elementary school in which the general public and fifth- and sixth-grade students respectively participated. As shown in Figure 4 (Left), the Nakajima school district (5,405 people as of June 2019), is located on the west side of the Miya River (91 km long with a basin area of 920 km$^2$), and there is a risk of sediment-related disasters in the area known as Sango mountain (142m altitude). In recent years, flooding has occurred in 2004 and 2017 due to poor drainage caused by rising water levels in the Miya River. As part of disaster prevention efforts in the area, annual evacuation drills are held by each local community association, and disaster education is provided at elementary and junior high schools using disaster education notebooks created by the Mie prefecture. In addition, disaster prevention events are held in collaboration between the elementary school and the local community as above-mentioned, with the cooperation of university researchers (including one of the authors). However, after the levee maintenance was completed after the 2004 disaster, the residents' awareness of flooding has weakened somewhat due to a sense of safety, and their awareness of evacuation is not particularly high (based on interviews with residents). Although there is a risk of flooding and sediment disasters, and measures are being taken to prepare for them, the situation has not yet reached the point where people actually take action during heavy rain. This point is not different from the situation in many other areas of Japan.

The scenario of Ametore in this case study was based on a landslide on Sango Mountain and the overflow of the Miya River. In the scenario, some of the information presented is common with the cases of Mexico, such as local disaster prevention information, rainfall radar and local disaster prevention information; however, in Japan, the widely known disaster risk level (information indicating five levels of danger on a 1 km mesh, details Japan Meteorological Agency (2017)) is also the target. The options for action in the cases of Japan were (1) normal life (stay at home and watch the situation as usual), (2) disaster preparation (prepare for disasters, including power and water outages), (3) family meeting (discuss with family), (4) upstairs (stay upstairs), (5) evacuation preparation (prepare for evacuation), and (6) evacuation to shelter (evacuate to a safe place).

The applications in Mexico were conducted with the same content at a community disaster management meeting in the Caimba district of Pichucalco City, Chiapas State, Mexico, and in two classes at Colbach 231 High School located in Pichucalco.

Pichucalco (population 31,919 as of 2020) is located in the northern inland region of the state of Chiapas, as shown in Figure 4 (Right), and is surrounded by mountains with Cerro La Ventana as the highest peak on the west side, with the Pichucalco River flowing on the east side, and smaller rivers flowing through the city as tributaries. In addition to cases where the city has been flooded during heavy rain, there are slopes on the northwest side of the participating Caimba District, which has experienced landslides in the past (2022), and residents are highly aware of disasters. However, high school students live in surrounding areas, and their awareness of disaster risk is considered to be different. In terms of disaster education, the administrative management of public schools at national level is performed by the Ministry of Public Education (SEP), while the development and implementation of disaster risk reduction programs in the territories are handled by the Ministry of Science and Education of each of the 32 states that conforms the Mexican Republic, usually in co-participation of the Ministry of Civil Protection of the state government. Regarding their governmental structure, Pichucalco educational sector and civil protection sector respond directly to their state ministries in a centralized way. Interestingly, Chiapas state have ranked first in the country in the Governance of Civil Protection Indicator (IGR) published by CENAPRED in 2024 and have been pioneer in developing Civil Protection educational strategies through the "Resilient schools project" which makes all schools to discuss every week a subject related with civil protection (Chiapas State Government, 2025). The targeted

**IDRiM (2025) 15 (1)** **ISSN: 2185-8322**
DOI10.5595/001c.140724

high school is also keenly engaged in disaster education, although this includes more than just natural disasters. On the other hand, disaster prevention activities targeting each community are not sufficient, and in Pochucalco, activities are basically limited to those led by local disaster prevention officers and community representatives. In this situation, the workshop in this study was also held as part of the promotion of local disaster prevention activities.

According to the National Risk Atlas, weather and landscape in Pichucalco makes it very prone to the presence of heavy rains, flooding and landslides while at the same time, it is considered highly vulnerable to its effects due to its economic situation. The state of Chiapas shares climatic and economic marginality conditions with a significative part of the south of the county, making results extrapolable to other parts of the country (National Risk Atlas, 2025).

The scenarios in Ametore were reconstructed in the form of a disaster based on the case of Tropical Storm Karl in October 2022 in the target district. The scenario involved three landslides and flooding of the area owing to intermittent heavy rains. The content of the scenario and the implementation procedures were coordinated and confirmed with the Mexican co-author as well as by state authorities involved in the study.

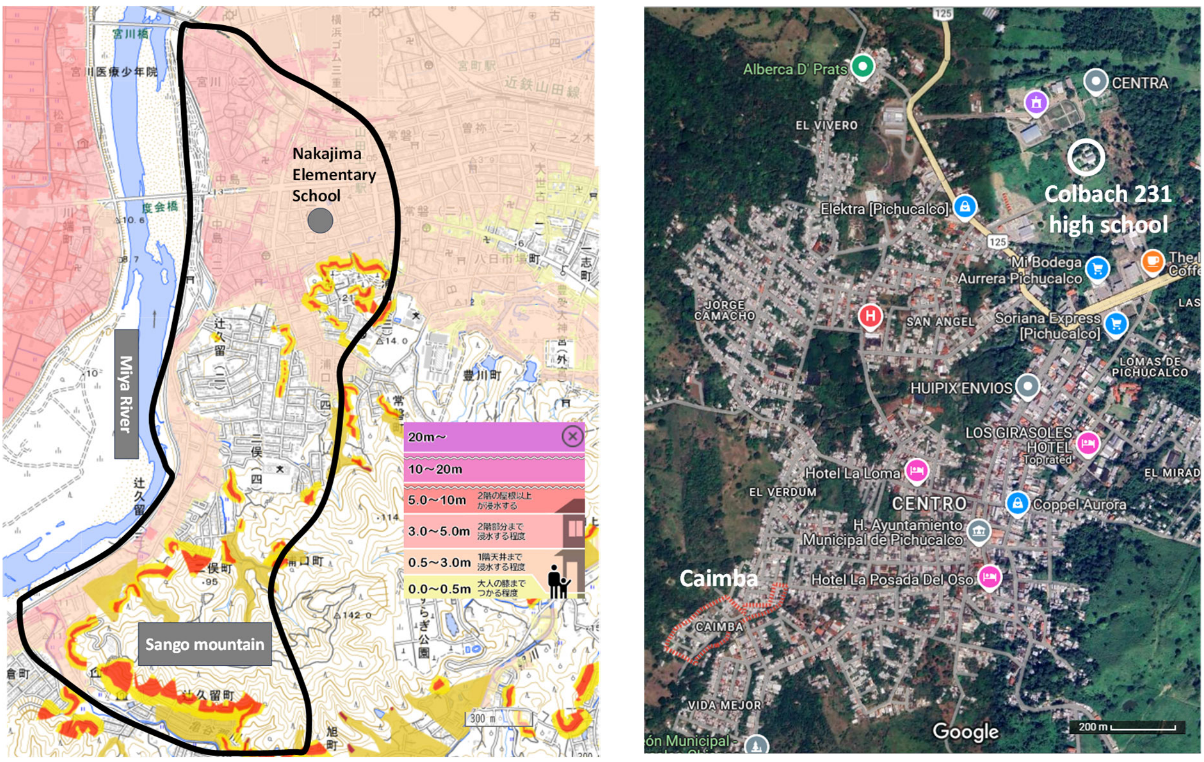


**Figure 4.** Research fields

Note. (Left: Nakajima School District, Ise City, Mie Prefecture, Japan; The author added to the map created using the "Overlapping Hazard Map". Right: Pichucalco City, Chiapas State, Mexico; The author added to the Google map)

DOI10.5595/001c.140724

**Table 1.** Research fields and settings of Ametore

| | Case | Japanese residents | Japanese students | Mexican residents | Mexican students |
|---|---|---|---|---|---|
| Target | Implementation Districts | Nakajima School District, Ise City, Mie Prefecture, Japan | | Pichucalco City, Chiapas State, Mexico | |
| | Disaster Risk | Flooding of the Miya River | | Landslide in the district<br>Flooding of streams in the district | |
| Workshop | Implementation Date | June 22, 2019 (1st and 2nd) | | November 8, 2023 (1st*) | September 20, 2023 (1st), November 9, 2023 (2nd) |
| | Number of Participants | 88 (general residents) | 77 (5th and 6th graders in elementary school) | 23 (general residents) | 49 (high school students) |
| Scenario | Reference case | Typhoon No. 21 of 2017 (October 22–23, 2017) | | Tropical Storm Karl, 2022 (October 14–15, 2022) | |
| | Training Setup | · Applied type of past cases in the target area<br>· Prolonged rainfall of Typhoon No. 21 in 2017<br>· Targeted disasters are flooding, inland flooding, and landslides | | · Application type of past cases in the target area<br>· Disaster generation type of Tropical Storm Karl 2022<br>· Flooding and sediment disasters | |
| | Scenario time (set date and time) | 14 hours (June 15, 16:00 to the next day, 6:00) | | 11 hours and 30 minutes (October 14, 12:30 p.m. – 7:00 a.m. the next day) | 11 hours 30 minutes (Oct. 14, 12:30 p.m. – 7:00 p.m. the next day + 1:20 p.m. the next day) |
| | Disaster occurrence in scenario | District partially flooded (18:10, June 15)<br>Landslide in Sango Mountain (02:10 pm, June 16)<br>Miya River flooding (04:40, June 16) | | Landslides occurred in the city (01:30, 02:30, 03:30 Oct. 15), flooding in the area (06:40, Oct. 15) | |
| Training | Training time | 14min.<br>(60x speed) | | 9 minutes 15 seconds<br>(120x speed) | |
| | Information to be presented | Local disaster prevention information, Rainfall radar, Local conditions and events, Flood risk level (Miya river water level), Landslide risk level | | Local disaster prevention information, Rainfall radar, Local conditions and events, Point meteorological observation information (rainfall conditions, temperature, wind speed) | |
| | Action selection | 6 items<br>(selected hourly) | | 6 items + others<br>(every 1–2 hours for a total of 12 sessions) | |

Note. *not conducted in the second trial because of time constraints.

Some of the information types presented are common with the cases in Japan; however, there is not the same detailed information like mesh of disaster risk level in Mexico (only the municipal color alerts delivered by the state government, details of the mechanism can be found at Chiapas Civil Protection Secretariat (2025)), so basic weather information, such as observation information at surrounding points and observations of nearby points, is used.

The action options in the cases of Mexico were (1) check information, (2) disaster preparation (prepare emergency bag), (3) family meeting, (4) preparation against flooding (move furniture, upstairs), (5) evacuation preparation, (6) evacuation to shelter, and (7) others, with only the option (1) and (4) slightly different and the option "other" available. This is in consideration of the possibility that the response actions in Mexico may differ from those in Japan. Only the timing of action selection differed slightly between the cases in Mexico.

Table 2 shows the questionnaire items commonly used in the cases of Japan and Mexico. Each questionnaire was conducted on paper immediately after the Ametore event, however, Q2-1 to Q2-3 were conducted only in Mexico to understand the situation specific to that region. The content can be broadly divided into "Impressions of the Ametore experience and related information" and "Confirmation of personal disaster awareness". In conducting the international comparison mentioned in 2.2, each questionnaire item was selected as necessary for discussing differences in disaster response through Ametore. We first analyze whether disaster awareness (Q2-1) and disaster experience (Q2-2) are related to disaster response in Ametore in 4.1. These are items that are often used in discussions on disaster response. In addition, in relation to the timing of disaster response in 2.1, we also confirm the factors that influenced disaster response in Ametore from difficulty of information (Q1-3), triggers for action (Q1-5), and appropriateness of timing of action (Q1-4) in 4.2. Balance of roles of self-help, mutual aid, and public assistance (Q2-3) is used in 4.3 to compare Japan and Mexico field backgrounds. Difficulty of Ametore (Q1-1) and sense of reality of Ametore (Q1-2) are used as reference to check whether there were any problems with the implementation of Ametore.

## 4. RESULT

### 4.1 Comparison of Disaster Response Results in Ametore

Regarding Ametore's choice of action, because similar trends were observed in the cases in Japan, and because a second trial was not conducted for the case of Mexican residents owing to time constraints, the results of Ametore trials except for the case of Mexican residents were used here to compare similarities and differences among the cases of Japan and Mexico. The results for the combined cases of residents and students in Japan and for the case of Mexican students are shown in Figure 5 and Figure 6, respectively.

**Table 2.** Questionnaire items

| No | Question Content | Options |
|---|---|---|
| Impressions of the Ametore experience and related information | | |
| 1-1 | Difficulty: Was Ametore difficult (SA)? | 1. Not difficult 2. somewhat not difficult 3. somewhat difficult 4. Difficult |
| 1-2 | Reality of sense: Did you recognize this training as a real disaster? (SA) | 1. I recognized it. 2. I somewhat recognized it. 3. I somewhat didn't recognize it. 4. I didn't recognize it |
| 1-3 | Difficulty of information: Was there any information that was difficult for you? (MA) | (Common) Disaster prevention information, rainfall radar, local conditions and events, none in particular (Only cases in Japan) flood risk level (water level), landslide risk level, (Only cases in Mexico) point meteorological observation information |
| 1-4 | Appropriateness of timing of action: How was the timing of your action? (SA) | 1. I should have taken action earlier<br>2. I should have taken action somewhat earlier<br>3. My actions were done in just the right time<br>4. Later actions were somewhat acceptable<br>5. Later actions were acceptable<br>6. I needed to take no action |
| 1-5 | (Triggers for action) Which information in particular led you to choose your action? (MA) | (Common) Disaster prevention information, rainfall radar, local conditions and events, none in particular (Only cases in Japan) flood risk level (water level), landslide risk level, (Only cases in Mexico) point meteorological observation information |
| Confirmation of personal disaster awareness | | |
| 2-1* | Disaster awareness: To what extent are you aware of disasters on a daily basis? (earthquake, flood, landslide, wind storm) (SA) | 1. Very aware 2. somewhat aware 3. somewhat unaware 4. Unaware |
| 2-2* | Disaster experience: Have you ever experienced any disaster? (MA) | Earthquake big enough to collapse the house, flood, landslide, storm damage, others |
| 2-3* | Balance of roles of self-help, mutual aid, and public assistance: Where do you think the focus should be in disaster preparedness? (Comparison with previous survey) (SA) | 1. Government 2. community 3. self-help 4. balance in the whole 5. others |

Note. *Only conducted in the cases of Mexico; SA: Single answer; MA: Multiple answer

Figure 5 and Figure 6 help us identify the similarities and differences between the cases in Japan and Mexico. First, as a commonality, the proportion of early-stage actions such as “normal life” and “check information” declines with the passage of time in both cases, and the proportion of safety-oriented actions such as “evacuation preparation” and “upstairs” increases. This is a reasonable and expected trend for both cases in the context of situational changes. We did observe some differences. In the case of Mexico, the percentage of “evacuation to shelter” increased over time, while the percentages of “others” and “no response” increased in the latter half of the survey. This difference can be attributed to the fact that the cases of Japan did not have an “others” option, but students tended to take various actions such as moving to relatives’ homes in addition to “evacuation to shelter” as “others.” All of them, with the exception of two students who chose “evacuation to shelter,” were in the time period after they chose "evacuation to a shelter," and most of them are considered to be in a situation where they judged that their choice of action was unnecessary. Therefore, "no response" can be considered equivalent to "evacuation to a shelter." The results of the difference in disaster response between the first and second trials showed that, in the cases of Japan, 30–50% of the participants changed to safer actions in the second trial based on their reflections on the first trial, while only about 5% of the participants changed to unsafe actions. In the case of Mexico, the percentage of "no change" was lower than that of the cases of Japan, and depending on the timing, around 30% changed to safer action and 30–60% to unsafe action, which is different from the results in the cases of Japan. In particular, the percentage of "unsafe" groups tended to increase with time before the disaster occurred.

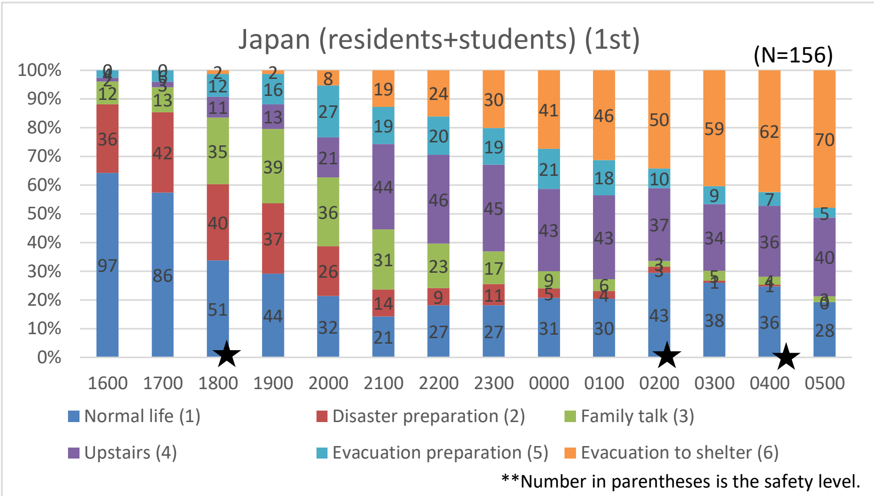


**Figure 5a.** Ametore results for the combined cases of residents and students in Japan (Percentage of choices in the 1st trial)

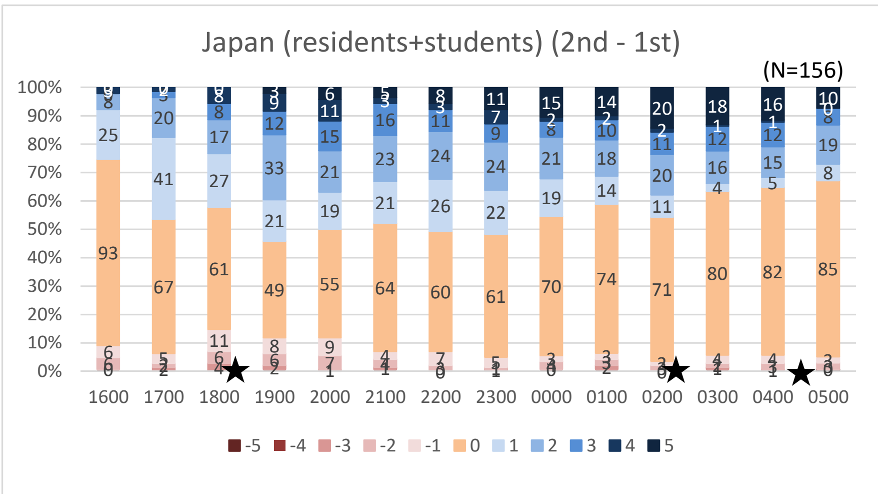


**Figure 5b.** Ametore results for the combined cases of residents and students in Japan (Difference of results between 1st and 2nd (2nd - 1st). **)

Note. *A star in the figures signifies a disaster occurrence. **The results are calculated by quantifying the action alternatives as positive, with those that are safer being considered positive, with those that are safer being considered positive.

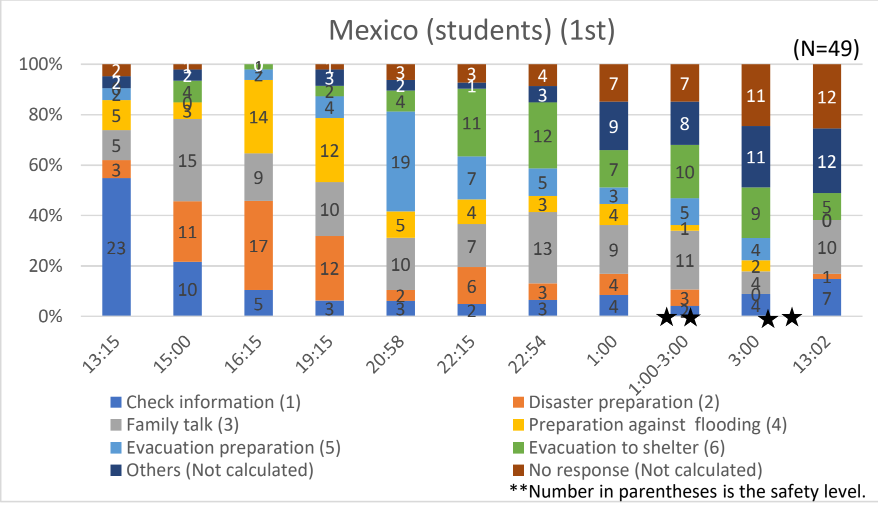


**Figure 6a.** Ametore results for the case of Mexican students (Percentage of choices on the 1st trial)

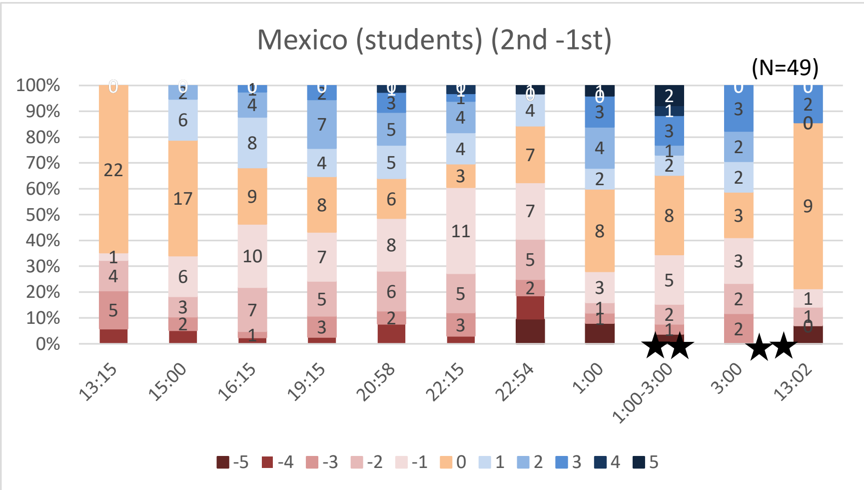


**Figure 6b.** Ametore results for the case of Mexican students (Difference of results between 1st and 2nd (2nd - 1st)**)

Note. *A star in the figures signifies a disaster occurrence.**The results are calculated by quantifying the action alternatives as positive, with those that are safer being considered positive.

The results of the first Ametore trial for residents and high school students in Mexico are shown in Figure 7. The percentage of respondents who began “evacuating to shelter” increased immediately before the landslide occurred in the case of Mexican residents. Even after the occurrence of the disaster, most of the participants indicate “evacuation to shelter,” unlike the case of Mexican students, where items other than “evacuation to a shelter” are identified. This may be because the Mexican residents had experience with landslides and were more aware of the risks, while the high school students lived around the city, and thus had different disaster risks. This is confirmed by the results of a question asking disaster awareness (Q2-1), where the residents had the highest awareness of “landslide,” which generally requires moving from place to place to avoid danger, at 80% (Very aware), which was more pronounced than 50% of the high school students who showed the highest awareness of “flood” at 73% (Very aware). The results of a question asking past disaster experiences (Q2-2) also showed that the residents had a higher experience than the high school students about “landslide”, and the students had a remarkable 73% experience of flood damage, suggesting that they chose to respond to such damage and that their responses would differ depending on the type of disaster (Figure 8). This difference between residents and students in the cases of Mexico may be due to the school environment. Japanese elementary school students in the case of Japan lived in the same district as the residents, so there may not have been a difference. Therefore, when discussing Ametore from the perspective of disaster education, it is necessary to take into account the characteristics of the school.

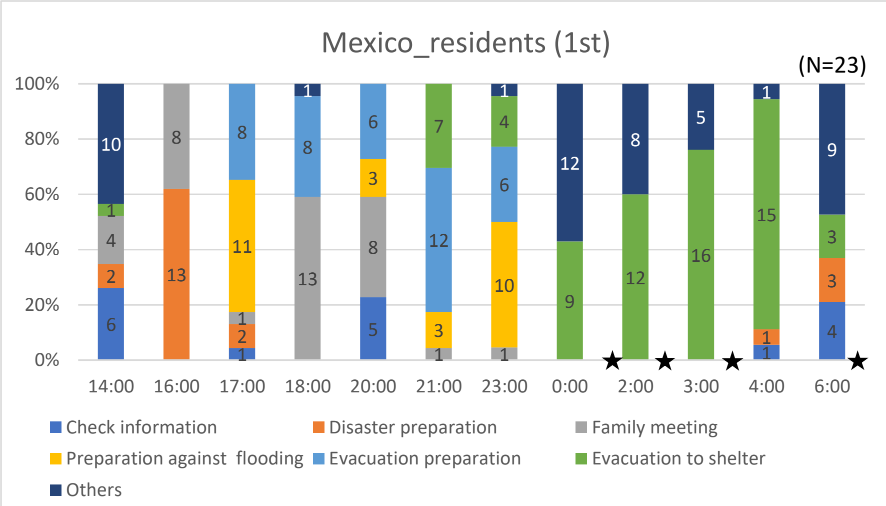


**Figure 7.** Ametore results for the case of Mexican residents
Note. *A star signifies a disaster occurrence.

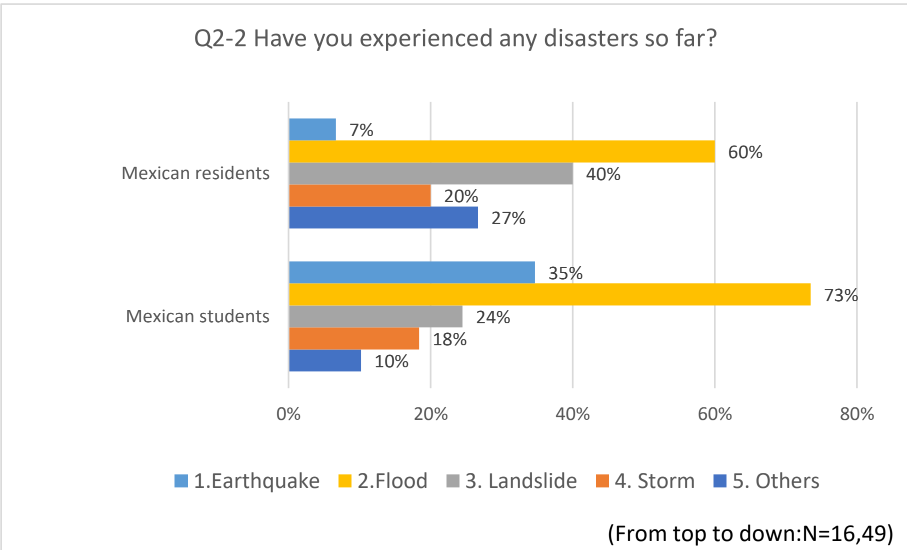


**Figure 8.** Disaster experience in the cases in Mexico (Q2-2)

### 4.2 Comparison of Factors Influencing Disaster Response through Questionnaire Results

Next, factors influencing disaster response were compared based on the results of the questionnaire.

First, when asked about the level of difficulty for each piece of information (Q1-3). In the cases of Japan, the most common response was “none in particular (about 35%),” followed by “landslide risk level (28%)” and “flood risk level (water level) (15%),” which were somewhat specialized pieces of information that were difficult. However, the most common response in both the cases of Mexico was that “point meteorological observation information” was difficult, at 48% on average, followed by “rainfall radar (38% on average)” and “local conditions and events (34% on average),” indicating that respondents were not familiar with disaster information and understanding disaster situations.

When asked what information actually triggered their choice of action (Q1-5), the highest percentage in the cases of Japan was “flood risk level (water level) (51%),” which 15% of respondents found difficult in Q1-3, followed by “rainfall radar(28%). In the cases of Mexico, “local disaster information (66%),” which had the smallest percentage of respondents (14%) who found it difficult in Q1-3, had the highest percentage, followed by “point meteorological observation information (56%),” which had the next highest percentage (48%) who found it difficult. The results of a question (Q1-4) that asked the appropriateness of action timing showed that 57% of respondents in the cases of Japan and 92% in those of Mexico answered “I should have taken action earlier” and “I should have taken actions somewhat earlier,” Through Ametore, awareness of improvement in action timing was higher in the cases of Mexico than in those of Japan (Figure 9). In both countries, the percentage of residents was higher than that of students.

In order to confirm whether there were any difficulties in using Ametore, level of difficulty was asked (Q1-1), and found that, on average, about 69% of respondents in Japan and 91% in Mexico answered “not difficult” or “somewhat not difficult” (Figure 10). This suggests that there were no major problems with utilizing the tool itself. In the cases of both the countries, the residents had a better understanding than the students. On the other hand, when asked if participants recognized the Ametore as real disaster (Q1-2), about 86% of respondents in Japan and 34% in Mexico answered “I recognized it” or “I somewhat recognized it” (Figure 11). In the cases of Japan, the scenario was perceived as realistic as if they were actual cases. In the cases of Mexico, a sense of reality was not sufficiently obtained, with approximately 87% in the case of Mexican residents and 59% in that of Mexican students responding negatively, with the residents tending to be more negative. On the other hand, when this research is viewed as a form of simulated experiential learning, considering the unfamiliarity with disaster information in Mexico, etc., it shows the possibility of further improvement as a learning tool by considering the scenario content and flow.

ISSN: 2185-8322
DOI10.5595/001c.140724

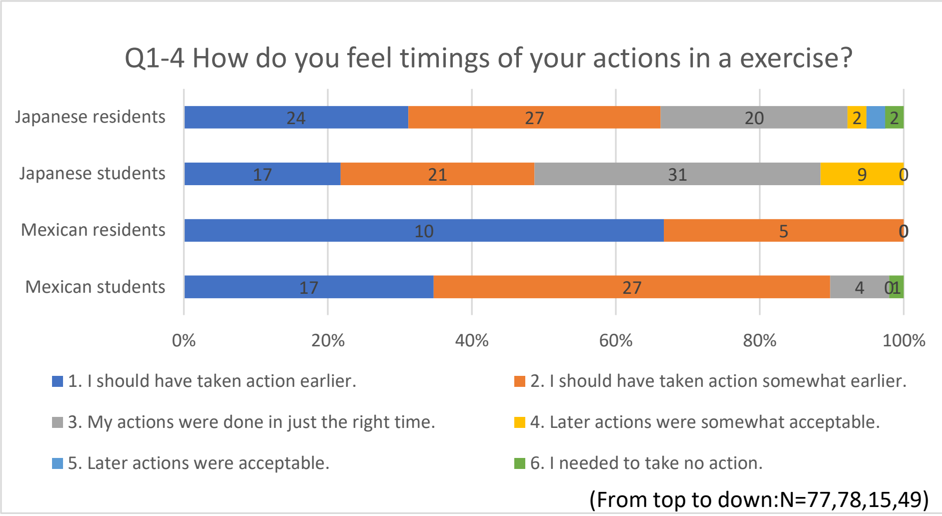


**Figure 9.** Appropriateness of timing of action (Q1-4)

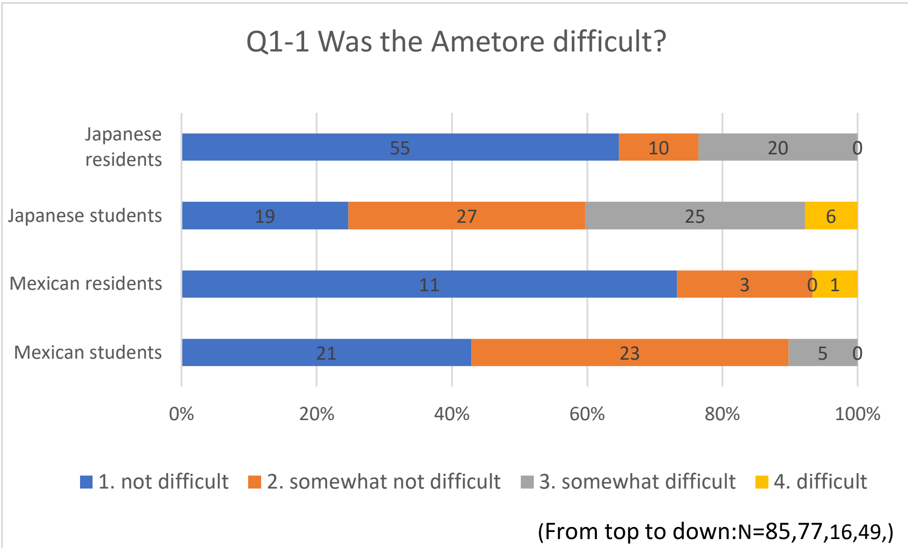


**Figure 10.** Difficulty of Ametore tool (Q1-1)

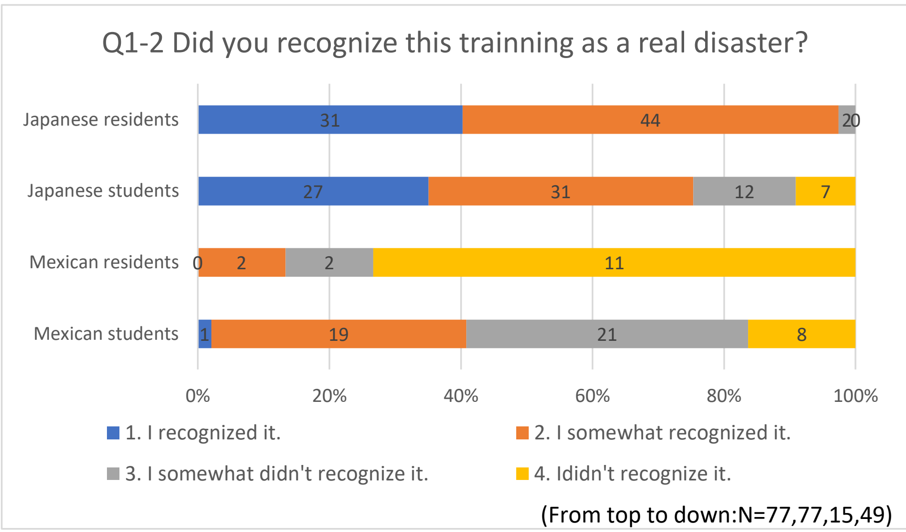


**Figure 11.** Reality through Ametore (Q1-2)

### 4.3 Comparison of Field Background

Along with the comparative results, we conclude with a comparison of the backgrounds of each field. In this section, we focus on the differences between Japan and Mexico in terms of the occurrence of natural disasters, perceptions of disaster policies, and disaster information.

First, we review the similarities between natural disasters in the two countries. As shown in Section 1, there are similarities between the two countries in terms of natural disasters and total population.

Second, in Japan, disaster response is often discussed in terms of how people should respond to disasters based on the division of responsibility among self-help, mutual aid, and public assistance. Self-help refers to the norm that individuals need to protect themselves, mutual aid refers to helping each other within the community, and public assistance refers to governmental efforts and responsibilities (Yamazaki, 2019). A comparison between the survey results in Japan (Cabinet Office, 2022) and the results of a question confirming the same thing in the cases of Mexico (Q2-3) are shown in Figure 12. “Community” and “balance in the whole” are slightly more prevalent among Mexican students, but not significantly different compared to other cases. Perceptions of disaster policies may be similar in Japan and Mexico.

Finally, disaster information, which is also an important element in Ametore, is compared based on the information used in this study and the opinions of those involved in scenario development. A distinctive feature of the case in Japan is that highly specialized information, which is not used in Mexico, such as flood risk level (water level) and landslide risk level, is displayed in five levels of color for easy understanding and is presented in scenarios at a high frequency every hour (every 10 minutes in actual society). In fact, the Japan Meteorological Agency has positioned this type of risk information, “Kikikuru,” as a cornerstone of its disaster response support, and is promoting its use through the media and other means. The number of water level observation points has been increasing in recent years, and the horizontal resolution of Kikikuru is as high as 1 km, making it possible to recognize familiar information.

In Mexico, the agency in charge to deliver meteorological warnings is CONAGUA through the National meteorological system which provides updated information to the state ministry of civil protection in charge to disseminate and respond to meteorological warnings, it is possible to access real time information and warnings. Particularly to the state of Chiapas, their procedures are called PROCEDA. However, information for the general public, other than observation information, is mainly general warnings and evacuation information from governmental organizations, etc. According to the opinions of some governmental officials related to this study, information indicating disaster risk is not sufficiently used at the general level, even specialized organizations seldom develop and disseminate information in a manner as advanced as Japan does. This opinion is important in evaluating the actual use of disaster information in Mexico.

**IDRiM (2025) 15 (1)** **ISSN: 2185-8322**
DOI10.5595/001c.140724

Pichucalco has just started observing the punctual rainfall through the meteorological station installed, and basic observation information is not generally used by the general public, other than TV, web based meteorological pages and reports from the national agency CONAGUA. For instance, Ponce-Pacheco et al. (2021) find that, in the state of Chiapas, where Pichucalco is located, interviewees were able to watch TV and listen to music online; 34% of the interviewees had a television, 21% had a computer with Internet access, and only a few had graduated from college. According to the National Council for the Evaluation of Social Development Policy (CONEVAL), in 2020, the main industry of Pichucalco is cattle raising and 47.9% of the population of Pichucalco was considered to live in moderate poverty, and 13% lived in extreme poverty. This may be related to a lack of knowledge about disasters.

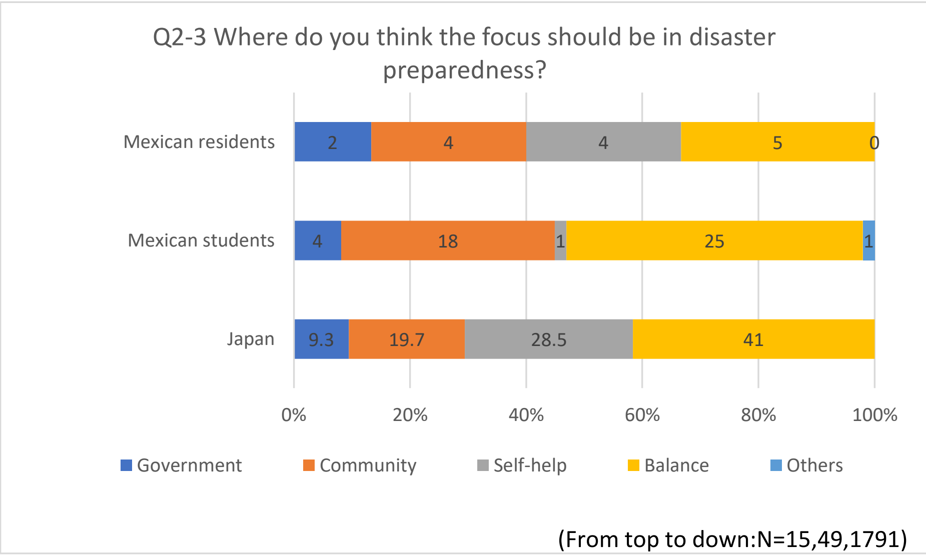


**Figure 12.** Balance of roles among self-help, mutual aid, and public assistance (Q2-3)

## 5. DISCUSSION

### 5.1 Differences in Attitudes toward Disaster Response through Ametore

Based on the results of two Ametore cases from each of Japan and Mexico including students and residents, we compare and analyze the differences in perceptions of disaster response between communities in the two countries. In the cases of both the countries, a tendency to take safer actions was observed as the risk of disaster increased. However, a significant difference was observed between the first and second trials. In the cases of Japan, participants tended to take safer actions earlier after judging that their actions were late in the first trial (Figure 5b). In the case of Mexico, however, almost 60% of the participants were more likely to take unsafe actions in the second trial than in the first, depending on the timing (Figure 6b). Considering that, in a question that asked the appropriateness of action timing (Q1-4), the Mexican participants also felt that they should have acted earlier, this may mean that having understood what would actually happen in the first trial, they felt psychologically reassured that they would be safe until just before a disaster occurred.

One of Ametore's goals is to provide simulated disaster experiences so that participants can be reminded to take appropriate action at the right time. However, the results of this study do not simply mean that people become safer in terms of both time and action but rather that changes manifest differently depending on the country's way of thinking and how it perceives disasters as well as the present social environment, such as fear to lose property or to be stolen. In fact, in Japan, early response actions are promoted on the premise of “early evacuation” and “don't be afraid to strike out (with disaster information).” However, the situation is different in Mexico. For example, the risk perception survey by Ponce-Pacheco et al. (2021) confirmed the lack of knowledge about disasters among residents of Chiapas, and 79% of respondents said they would migrate if they had the money to do so, indicating a social environment in which livelihoods may be prioritized over disasters. This indicates that disaster response was not a priority. As Thiede and Brown (2013) pointed out, it is also necessary to discuss whether or not a social environment allows for evacuation in the first place.

Given these differences in attitudes toward disaster response, disaster response can be said to be a very complex system as the results of the past surveys in 2.1. As discussed in Hidaka et al. (2024) and McLennan et al. (2019), the effectiveness and purpose of Ametore's simulated disaster experience must consider both individual characteristics and social context. In Japan, people have a higher awareness of disasters and repeated experiences of various simulated disasters can naturally lead to the development of the ability to make appropriate judgments regarding the content and timing of responses. Mexico, on the other hand, lacks sufficient disaster information and information literacy, which may lead to the perception that it is sufficient to act just before danger becomes imminent. Therefore, it is necessary to combine this with education on disaster response or to use a different scenario to make the participants understand that there is a risk of being hit by a disaster if they do not follow the same approach and to promote the call for action at a safer time. This indicates that the initiatives already being implemented in the Chiapas are important for future discussions. Of course, we need to mention that this varies by regions. In Japan, there are also situations that disaster information can’t be fully utilized. In Mexico, home rule imply that each state determines the way in which they look to archive the aims of the national civil protection sectorial plans, resulting in variability between strategies, nevertheless, similar conditions are shared between significative areas of the country as showed in the spatial analysis retrieved from National Risk Atlas (2025). It is also true that it is difficult to make a perfect relative comparison between countries in discussions on disaster response, but through the comparisons as described above, significative findings can be obtained, difficult to discover though single country analysis.

### 5.2 Disaster Information and Society as Seen from Ametore

From the case studies of Ametore in Japan and Mexico, differences were identified between the disaster information environments, and how disaster information is perceived in

DOI10.5595/001c.140724

society. The results of asking about the level of difficulty for each piece of information (Q1-3) and asking what information actually triggered their choice of action (Q1-5) confirm that communities in Mexico can lack sufficient familiar and easy-to-understand disaster risk information compared with ones in Japan. Rainfall radar and point meteorological observation values are the basic elements of weather observation and provide common information for both countries. However, it is difficult in both Japan and Mexico to recognize whether a hazard is dangerous based on these factors alone and requires a certain amount of experience and knowledge. In this context, Japan has been discussing over the past decades how to communicate disaster risks in an easy-to-understand manner and how to develop information for this purpose (e.g., Deshimaru, 2014; Takahashi, 2022). In the cases of Japan, a higher or equivalent percentage of respondents were triggered to take action by the disaster risk level of disasters than by familiar "local disaster prevention information " or "local conditions and events," and none of the difficult information exceeded 30% of the respondents. In the cases of Mexico, "local disaster prevention information" and "point meteorological observation information" were triggers for action, but the percentage of respondents who chose "none in particular" as difficult information was lower than in the cases of Japan. This may be why the respondents answered that Ametore was not difficult, but did not get a sense of reality from Ametore. Thus, compared to Japan, the study areas in Mexico seems unfamiliar with the idea of thinking about something based on weather forecast and expected rainfall measures, relying more on environmental cues that are not early indicators for early response. These results can be discussed in relation to the timing of disaster response in 2.1, as well as the relationship between disaster information and evacuation in Bean et al. (2023) and Takenouchi and Yamori (2020), and can provide useful findings for future evacuation models (e.g. Lindell & Perry, 2012).

In recent years, Japan has become increasingly dependent on information owing to the increasing sophistication of disaster information (Katada et al., 2011). However, information is provided in phases or quantitatively so that even those without knowledge of disasters can understand what kind of hazard is dangerous and how dangerous it is by visualizing the level of danger as directly familiar information, such as color-coded maps showing the level of danger for each disaster or by increasing the number of river-level observation points. The result that few people found the information difficult to understand shows that this information can be effective in relaying risk perception.

In Mexico, general information is expressed in words, such as simple observational data or qualitative warnings, and it is difficult to judge whether the information is dangerous without knowledge of the information provided and how to use it. Redundant verbal information takes longer to process and individual differences in the perception of danger are more likely to occur. Although there are color alerts that cover a certain range, they are not yet sufficiently useful for general use and have low resolution.

In light of these differences, the use of Ametore to understand what kind of disaster information is available and how to use it is particularly important in contexts like the one of

IDRiM (2025) 15 (1) ISSN: 2185-8322
DOI10.5595/001c.140724

the cases in Mexico as disaster education and training, where disaster information is not fully utilized. As Paton et al. (2013) discussed, this is a glimpse of one aspect of international equivalence and heterogeneity, and it makes up for the lack of international comparison pointed out in 2.2. Like the above results, international comparisons can provide important suggestions for discussing the modeling of disaster responses.

In addition to Mexico, this kind of individual differences needs to be discussed, including in Japan. As shown in 2.1, there are studies that have investigated a lot of evacuation cases in the past and discussed the factors that affect evacuation, but as Ferdinandus et al. (2013) pointed out, there is not enough research that applies this as training and also targets personalization. However, Ametore can narrowed down the focus to information presentation and responses to that information, and lower the hurdle. In the cases of Japan and Mexico, the importance of using disaster scenario information as an educational tool was confirmed. As discussed in the second half of 2.1, this indicates the need to focus on the aspect of experiential learning.

## 6. CONCLUSION

Through a comparison of case studies from Japan and Mexico, this study examined the differences in disaster response in Ametore, a disaster response simulation tool, in order to understand the effectiveness of the tool in improving disaster response.

In the cases of both the countries, as disaster risk increased, the percentage of actions taken in favor of safety increased. In comparison of the first and second trials, the proportion of safety-oriented actions increased and the timing for taking safety-oriented actions became earlier in the cases of Japan, while the proportion of safety-oriented actions decreased and the timing for taking safety-oriented actions became later in the case of Mexico. These results confirm that the effects of Ametore differ depending on the social environment and attitudes toward disasters in each region. Thus, Ametore is also a teaching and training instrument, as Kleiboer (1997) points out in his discussion of the role of simulation, but as this study has shown, it can also be used as a research tool by making use of the results.

A comparison of the Ametore scenarios and questionnaire results revealed differences between disaster information environments evaluated in Japan and Mexico. In Japan, disaster information is well discussed and there is a large amount of publicly available, easy-to-understand information on disaster risks and their understanding. In Mexico, basic data, such as observed data, are the main source of information and are not well known to the public of the areas. Therefore, the perception of disaster risk differs from one individual to another, and existing disaster information alone is insufficient to stimulate action.

Based on these results, it is important for Ametore to be used in Japan to promote more appropriate response actions in various scenarios, whereas in areas of Mexico with similar characteristics to Pichucalco, it is important to promote information understanding and discussion of information development through Ametore.

The results are discussed based on several case studies. In both Japan and Mexico, the results were highly influenced by regional and individual characteristics. This means that it is important to consider not only the comparison between countries, but also the impact of various factors such as education, economy, culture. It is necessary to refine the discussion in this study by comparing other communities and regions. As discribed in 2.2, promoting international comparisons of disaster responses, which is lacking at present, could lead to the development of more sophisticated models of disaster responses in the future, using a variety of approaches, such as the narrative approach (Naismith et al., 2024) and the systemic approach (Wang et al., 2021; Gehlot et al., 2019) discussed in 2.1. In addition, although this study focused on a specific disaster scenario, we did not analyze what kind of changes or effects on disaster responses would occur by experiencing various scenarios. It is critical we develop a tool that allows people to easily experience Ametore trials in a casual and simple manner. When considering that disasters do not occur frequently, it is necessary to discuss whether such simulated scenario experiences can have a long-term effect compared to other tools from the perspective of experiential learning. In the future, we hope to gain a deeper understanding of the relationship between disaster information and society based on the results of numerous participants through Ametore, which will lead to measures for utilizing disaster information in target areas. This means that Ametore can be used in a variety of situations and contexts, such as for disaster education and corporate training, and we will develop suitable methods of use for them, and create a social environment where simulations can be used in a familiar way for each entity. Pichucalco has installed observation equipment in the region, and it would also be interesting to create a scenario in which these observations are used in Ametore.

## ACKNOWLEDGEMENT

We thank the local residents and government officials in Japan and Mexico for their cooperation in conducting this study. In particular, we would like to express our great appreciation to the former Minister, Dr. Luis Manuel García Moreno, and its team, Eng. Jorge de Jesús Figueroa Cordova, Eng. Mario Molina Santiago, M. S. Priscila Esquinca Sol, B. Tania Cristel Ordoñez Ramirez, as well as B. José Alfredo Ruiz Hernández and Eng. Oscar Urbina Gómez from COLBACH for their cooperation in conducting this study in Mexico.

## FUNDING

This work was supported by JSPS KAKENHI (grant number 23K04330).

## DECLARATION OF CONFLICT OF INTEREST

The authors have no conflicts of interest directly relevant to the content of this article.

## REFERENCES

Al Kurdi, O.F. (2021). A critical comparative review of emergency and disaster management in the Arab world, *Journal of Business and Socio-economic Development*, *1*(1), 24–46. https:/doi.org/10.1108/JBSED-02-2021-0021

Appleby-Arnold, S., Brockdorff, N., Jakovljev, I., & Zdravković, S. (2021). Disaster preparedness and cultural factors: a comparative study in Romania and Malta, *Disasters*, *45*, 664–690. https://doi.org/10.1111/disa.12433

Bean, H., Takenouchi, K., & Cruz, A.M. (2023). Combining probabilistic hazard information forecast graphics with wireless emergency alert messages: an exploratory, qualitative study, *Weather, Climate, and Society, American Meteorological Society, 15*(4), 843–861. https://doi.org/10.1175/WCAS-D-22-0140.1

Buck, D.A., Trainor, J.A., &Aguirre, B.E. (2006). A critical evaluation of the incident command system and NIMS, *Journal of Homeland Security and Emergency Management*, *3*, 1–27.

Cabinet Office. (2022). *Public Opinion Survey on Disaster Prevention* (September 2022). https://survey.gov-online.go.jp/r04/r04-bousai/ (in Japanese)

Chen, S.C., & Wu, C.Y. (2014). Debris flow disaster prevention and mitigation of non-structural strategies in Taiwan, *Journal of Mountain Science*, *11*(2), 308–322. https://doi.org/10.1007/s11629-014-2987-3

Chiapas Civil Protection Secretariat. (2025). *A color code that visually represents the degree of danger caused by the rain.* https://www.proteccioncivil.chiapas.gob.mx/documentos/proceda.pdf (in Spanish)

Chiapas State Government. (2025). *Resilient schools project.* https://escuelasresilientes.chiapas.gob.mx/ProgramaER/LunesPreventivo (in Spanish)

Choi, S., & Do, M. (2019). Effect of evacuation information and evacuation behaviors on high-rise apartment residents, *KSCE Journal of Civil Engineering, 23*, 4886–4897. https://doi.org/10.1007/s12205-019-2126-3

Deshimaru, T. (2014). Recent improvements and future direction of disaster prevention weather information. *Special Issue on Future of Disaster Prevention Weather Information*, *Disaster Information*, *1*, 12–18. https://doi.org/10.24709/jasdis.12.0_12 (in Japanese)

EM-DAT. (2025). *The International Disaster Database.* https://www.emdat.be/

Felicio, S.P.A.S., Silva, V.S.R., Dargains, A.R., Souza, P.R.A., Sampaio, F., Carvalho, P.V.R., Gomes, J.O., & Borges, M.R.S. (2014). Stop disasters game experiment with elementary school students in Rio de Janeiro: Building safety culture. In ISCRAM 2014 Conference Proceedings - 11th International Conference on Information Systems for Crisis Response and Management, 585-591.

Ferdinandus, G.R., Peeters, M., Vanden Bosch K., & Meyer, J-JC. (2013). Automated scenario generation - coupling planning techniques with smart objects. In: Proceedings of the 5th International Conference on Computer Supported Education - 1: CSEDU. INSTICC, SciTePress, 7681.

Gehlot, H., Sadri, A.M., & Ukkusuri, S.V. (2019). Joint modeling of evacuation departure and travel times in hurricanes, *Transportation*, *46*, 2419–2440. https://doi.org/10.1007/s11116-018-9958-4

Hasan, S., Mesa-Arango, R., & Ukkusuri, S. (2013). A random-parameter hazard-based model to understand household evacuation timing behavior. *Transportation Research Part C, 27*, 108-116. https://doi.org/10.1016/j.trc.2011.06.005

Hidaka, K., Ikegai, M., & Masuda, S. (2024). Regression modeling of subjective probability of river inundation with epistemic uncertainty: a short-term panel data analysis. *Natural Hazards*, *120*, 6343-6375. https://doi.org/10.1007/s11069-024-06446-y

Izumi, T., & Shaw, R. (2022). A multi-country comparative analysis of the impact of COVID-19 and natural hazards in India, Japan, the Philippines, and USA. *International Journal of Disaster Risk Reduction*, *73*, 102899. https://doi.org/10.1016/j.ijdrr.2022.102899

Japan International Cooperation Agency. (2021). *Manual for preparing Hazard Maps*, APPENDIX II-1-3, final report of Project for Development of Regional Disaster Risk Resilience Plan in Central Sulawesi in the Republic of Indonesia. https://openjicareport.jica.go.jp/pdf/12342127_03.pdf

Japan Meteorological Agency. (2017). *Real-time Risk Map*. https://www.data.jma.go.jp/multi/index.html

Katada, T., Kinoshita, T., & Kanai, M. (2011). The influence of the dependent on government response about natural disaster upon preparedness. *Disaster Information*, *9*, 114–126. https://doi.org/10.24709/jasdis.9.0_114. (in Japanese)

Kawase, H., Nosaka, M., Watanabe, S.I., Yamamoto, K., Shimura, T., Naka, Y., Wu, Y.-H., Okachi, H., Hoshino, T., Ito, R., Sugimoto, S., Suzuki, C., Fukui, S., Takemi, T., Ishikawa, Y., Mori, N., Nakakita, E., Yamada, T.J., Murata, A., Nakaegawa, T., & Takayabu, I. (2023). Identifying robust changes of extreme precipitation in Japan from large ensemble 5-km-grid regional experiments for 4K warming scenario. *Journal of Geophysical Research*, *JGR-Atmosphere*, *128*(18). https://doi.org/10.1029/2023JD038513

Kleiboer, M. (1997). Simulation methodology for crisis management support. *Journal of Contingencies and Crisis Management, 5*, 198-206. https://doi.org/10.1111/1468-5973.00057

Kolb, D. A. (2014). *Experiential Learning Experience as the Source of Learning and Development*. New Jersey FT Press.

Lim, H.R., Lim, M.B.B. & Rojas, A.W.M. (2022). Towards modelling of evacuation behavior and planning for emergency logistics due to the Philippine Taal Volcanic eruption in 2020. *Natural Hazards, 114*, 553–581. https://doi.org/10.1007/s11069-022-05401-z

Lindell, M.K., Lu, J.C., & Prater, C.S. (2005). Household decision making and evacuation in response to Hurricane Lili. *Natural Hazards Review*, *6*, 171–179.

Lindell, M.K., & Perry, R.W. (2012). The protective action decision model: theoretical modifications and additional evidence, *Risk Analysis, 32*(4), 616-632. https://doi.org/10.1111/j.1539-6924.2011.01647.x

Lindell, M., Murray-Tuite, P., Wolshon, B., & Baker, E. (2018). *Large-Scale Evacuation: The Analysis, Modeling, and Management of Emergency Relocation from Hazardous Areas*. CRC Press. https://doi.org/10.4324/9781315119045

Malešič, M. (2020). Disaster response from a comparative perspective. *International Journal of Disaster Risk Reduction*, *48*, 101621. https://doi.org/10.1016/j.ijdrr.2020.101621.

McLennan, J., Ryan, B., Bearman, C., & Toh, K. (2019). Should we leave now? Behavioral factors in evacuation under wildfire threat. *Fire Technology*, *55*, 487–516. https://doi.org/10.1007/s10694-018-0753-8

Mossoux, S., Delcamp, A., Poppe, S., Michellier, C., Canters, F., & Kervyn, M. (2016). Hazagora: Will you survive the next disaster? – A serious game to raise awareness about geohazards and disaster risk reduction. *Natural Hazards and Earth System Sciences*, *16*(1), 135-147. https://doi.org/10.5194/nhess-16-135-2016, https://lirias.kuleuven.be/435182

Naismith, A.K., Phillips, J., Barclay, J., Armijos, M.T., Watson, I.M., Chigna W., & Chigna, G. (2024). Transitions: comparing timescales of eruption and evacuation at Volcán de Fuego (Guatemala) to understand relationships between hazard evolution and responsive action. *Journal of Applied Volcanology, 13*(3). https://doi.org/10.1186/s13617-023-00139-0

National Risk Atlas. (2025). *National Risk Information System*. http://www.atlasnacionalderiesgos.gob.mx/ (in Spanish)

Pan, A. (2020). Study on the decision-making behavior of evacuation for coastal residents under typhoon storm surge disaster. *International Journal of Disaster Risk Reduction*, *45*. https://doi.org/10.1016/j.ijdrr.2020.101522.

Paterson, B., & Charles, A. (2019). A global comparison of community-based responses to natural hazards. *Natural Hazards and Earth System Sciences*, *19*, 2465–2475. https://doi.org/10.5194/nhess-19-2465-2019

Paton, D., Okada, N., & Sagala, S. (2013). Understanding preparedness for natural hazards: Cross cultural comparison. *Journal of Integrated Disaster Risk Management*, *3*(1), 18–35.

Paton, D., Bajek, R., Okada, N., & McIvor, D. (2010). Predicting community earthquake preparedness: A cross-cultural comparison of Japan and New Zealand. *Natural Hazards*, *54*(3), 765–781.

Pham, E.O., Emrich, C.T., Li, Z., Mitchem, J., & Cutter, S.L. (2020). Evacuation departure timing during Hurricane Matthew. *American Meteorological Society*, *12*(2), 235–248. https://doi.org/10.1175/WCAS-D-19-0030.1

Ponce-Pacheco, A.B., Novelo-Casanova, D.A., Agustin-Ortíz, I.N., & Garduño-González, A.B. (2021). Risk perception in Unión Juárez, Chiapas, Mexico. *Natural Hazards, 106*, 855–879. https://doi.org/10.1007/s11069-020-04494-8

Practical Action. (2018). *Mock Flood Exercises in Communities Utilising Community-based Early Warning Systems*. https://practicalaction.org/knowledge-centre/resources/manual-for-mock-flood-response-exercise-with-early-warning-system-english/

Räsänen, A., Lein, H., Bird, D., & Setten, G. (2020). Conceptualizing community in disaster risk management. *International Journal of Disaster Risk Reduction*, *45*, 101485. https://doi.org/10.1016/j.ijdrr.2020.101485

Sarwar, M.T., Anastasopoulos, P.C., Ukkusuri, S.V., Md Tawfiq Sarwar, Panagiotis Ch. Anastasopoulos, Satish V. Ukkusuri, Murray-Tuite, P., & Mannering, F.L. (2018). A statistical analysis of the dynamics of household hurricane-evacuation decisions. *Transportation*, *45*, 51–70. https://doi.org/10.1007/s11116-016-9722-6

Shakeri, E., Vizvari, B., & Nazerian, R. (2021). Comparative analysis of disaster management between India and Nigeria. *International Journal of Disaster Risk Reduction*, *63*, 102448. https://doi.org/10.1016/j.ijdrr.2021.102448.

Solinska-Nowak, A., Magnuszewski, P., Curl, M., French, A., Keating, A., Mochizuki, J., Liu, W., Mechler, R., Kulakowska, M., Jarzabek, L. (2018). An overview of serious games for disaster risk management - prospects and limitations for informing actions to arrest increasing risk, *International Journal of Disaster Risk Reduction*, *31*, 1013–1029. https://doi.org/10.1016/j.ijdrr.2018.09.001.

Sorensen, J.H. (1991). When shall we leave? Factors affecting the timing of evacuation departures. *International Journal of Mass Emergencies and Disasters*, *9*(2), 153–165.

Takahashi, K. (2022). *Disaster prevention weather information and its effective use, Gifu prefecture disaster prevention weather lecture material*. https://www.jma-net.go.jp/gifu/shosai/news/pdf/2022/202211_kouenkai_shiryou.pdf (in Japanese)

Takenouchi, K. & Yamori, K. (2020). Synergistic Integration of Detailed Meteorological and Community Information for Evacuation from Weather Related Disasters: Proposal of a "Disaster Response Switch", *the International Journal of Disaster Risk Science, 11*(6), 762-775. https://doi.org/10.1007/s13753-020-00317-3.

Takenouchi, K., Honma, M., Yamori, K., & Suzuki, Y. (2021). Functional evaluation of training Pplatform for prospective exercise and retrospective review of disaster responses through water-related disaster cases. *Disaster Information*, *19*(1), 11–22. (in Japanese)

Thiede, B.C., & Brown, D.L. (2013). Hurricane Katrina: Who stayed and why? *Population Research and Policy Review, 32*, 803–824. https://doi.org/10.1007/s11113-013-9302-9

Tokyo Metropolitan Foundation Tsunagari. (2025). *About Flood Hazard Maps*. https://tabunka.tokyo-tsunagari.or.jp/english/disaster/howto/hazard_maps.html

Tsai, M.-H., Chang, Y.-L., Shiau, S., & Wang, S.-M. (2019). Exploring the effects of a serious game-based learning package for disaster prevention education: The case of Battle of Flooding Protection. *International Journal of Disaster Risk Reduction*, 43, 101393. https://doi.org/10.1016/J.IJDRR.2019.101393

UNDRR. (2015). *Sendai Framework for disaster risk reduction 2015-2030*. https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030

Wachinger, G., Renn, O., Begg, C., & Kuhlicke, C. (2013). The risk perception paradox-implications for governance and communication of natural hazards. *Risk Analysis*, *33*(6). https://doi.org/10.1111/j.1539-6924.2012.01942.x

Wang, Y., Kyriakidis, M., & Dang, V.N. (2021). Incorporating human factors in emergency evacuation- an overview of behavioral factors and models. *International Journal of Disaster Risk Reduction*, *60*. https://doi.org/10.1016/j.ijdrr.2021.102254

Wilcke, R.A.I., & Bärring, L. (2016). Selecting regional climate scenarios for impact modelling studies. *Environmental Modelling & Software*, *78*, 191–201. http://dx.doi.org/10.1016/j.envsoft.2016.01.002

World Meteorological Organization. (2021). *WMO Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970–2019).*

https://unfccc.int/sites/default/files/resource/2021.09.20%20-%20WMO%20Atlas%201970-2019.pdf

Yamazaki, N. (2019). Promoting Self-help, Mutual Aid, and Public Assistance in a Multilayered Approach, *Community disaster prevention*, *25*, 36-39. (in Japanese)

Yamori, K., & Sugiyama, T. (2020). Development and social implementation of smartphone app Nige-Tore for improving tsunami evacuation drills: Synergistic effects between commitment and contingency. *International Journal of Disaster Risk Science*, *11*, 751–761. https://doi.org/10.1007/s13753-020-00319-1

Yore, R., & Walker, J.F. (2020). Early warning systems and evacuation: rare and extreme versus frequent and small-scale tropical cyclones in the Philippines and Dominica. *Disasters*, *45*, 691–716. https://doi.org/10.1111/disa.12434