Journal of Hazard Literacy
eISSN 3091-6402

Original Article
J. Hazard Lit. 2025;1(3):e15
https://doi.org/10.63737/jhl.25.0023

Developing a skill-based framework for disaster literacy: insights from the 2023 Turkey earthquake and cross-cultural validation

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Abstract

This study aims to develop and validate a skill-based framework for disaster literacy by integrating field insights from disaster-affected populations with expert feedback from international disaster professionals. In the first phase, a set of 33 core disaster literacy skills was identified through qualitative interviews with 20 earthquake survivors and 19 firefighters who participated in search and rescue operations following the 2023 Turkey earthquakes. The skills were thematically categorized into three disaster phases: pre-disaster, during-disaster, and post-disaster. In the second phase, this framework was shared with 20 experts in the broad disaster field in the United States through a written consultation process inspired by the Delphi technique. Based on structured feedback from 12 experts, the skill set was revised for clarity, feasibility, universality, and community alignment—resulting in a final list of 35 disaster literacy skills. The revised framework emphasizes not only physical preparedness and emergency response but also digital information literacy, psychosocial resilience, and community coordination. This research contributes to the literature by offering a culturally informed, cross-contextual, and pedagogically actionable model for integrating disaster literacy into education and training programs. The findings highlight the need for multi-stakeholder collaboration and the integration of technological tools to enhance public disaster competence across diverse societies.

Keywords: disaster literacy, skill-based education, community resilience, disaster risk reduction, cross-cultural validation

Received: Jul 15, 2025
Revised: Sep 9, 2025
Accepted: Sep 30, 2025

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Conflict of interest
No potential conflict of interest relevant to this article was reported.

Funding sources
This study was supported by the Scientific and Technological Research Council of Turkey (TÜBİTAK) under the 2219 Postdoctoral Research Fellowship Program (Grant No: 2219-1059B192301696). The author also acknowledge institutional support from the University of Colorado Boulder Natural Hazards Centre and the University of Delaware Disaster Research Centre.

Introduction

The devastating effects of disasters on individuals and societies are not limited to physical destruction; they also deepen in the lack of multifaceted skills such as accessing information, making the right decisions, demonstrating psychological resilience and cooperating within the community. Therefore, it is accepted that being prepared for disasters is closely related not only to having knowledge but also to the capacity to apply this knowledge, i.e., "disaster literacy". Brown et al. [1] define disaster literacy as the ability to read, understand and use information to make informed decisions and follow instructions in the context of reducing, preparing, responding to and recovering from a disaster.

Acknowledgements
Not applicable.

Availability of data and material
Upon reasonable request, the datasets of this study can be available from the corresponding author.

Authors' contributions
The article is prepared by a single author.

Ethics approval and consent to participate
This study was conducted in accordance with ethical standards for research involving human participants. All participants were informed of the purpose of the study and provided voluntary verbal and/or written consent for participation. The study received ethical approval from the University of Delaware Institutional Review Board (IRB) with Category 2(ii) Exempt Status (Approval No. 2255340-1, January 14, 2025).

Disaster literacy is increasingly recognized as a critical determinant in reducing disaster risks and enhancing community resilience, particularly in disaster-prone areas [2]. It refers to individuals' ability to access, understand, evaluate, and apply disaster-related information to make informed decisions and follow preparedness, mitigation, response, and recovery procedures throughout their lives [3–5]. Rather than simply a body of knowledge, disaster literacy encompasses a multidimensional set of competencies that enable individuals to protect themselves and others, act responsibly during crises, and contribute to long-term resilience [6]. As a fundamental element of disaster risk reduction, disaster literacy acts as a catalyst for individual and collective action, enabling communities to minimize damage and disruption [3,7]. Individuals with high levels of disaster literacy are more likely to take proactive measures that not only ensure immediate safety but also support sustainable recovery and development. In this context, disaster literacy serves as a core competency, enabling people to recognize risks, adapt quickly, and make effective decisions, especially for those living in vulnerable environments [8]. In this context, the concept of disaster literacy has emerged as a fundamental component of societal resilience, encompassing the ability to access, understand, evaluate and apply knowledge and skills related to disaster preparedness, response and recovery.

Disaster literacy, an emerging interdisciplinary concept, extends far beyond traditional knowledge acquisition. According to Brown et al. [1], it encompasses the capacity to understand, interpret, and apply information across all phases of a disaster. However, recent studies advocate a broader interpretation that includes psychosocial resilience, digital competence, and decision-making capacity as integral components [9–11]. Disaster literacy as a moral and cognitive construct that directly impacts disaster response [12]. Despite this expanding perspective, most existing frameworks in the literature focus on increasing awareness or factual knowledge and offer little in the way of actionable, skills-based guidance. Addressing this gap, Karacaoğlu et al. [13] emphasize that disaster literacy education should serve as a practical tool that not only prepares individuals for emergencies but also equips them with the necessary competencies to manage disasters effectively. Building on this premise, the current study proposes a structured, transferable, and cross-culturally valid skills-based framework for disaster literacy. The framework is grounded in real-world insights and educational principles aligned with lifelong learning and community-based resilience. As emphasized in the Turkish Ministry of National Education's Disaster Awareness Course Curriculum [14] developing not only awareness but also applicable competencies is central to effective disaster preparedness. This alignment with the Ministry's curriculum demonstrates increased institutional awareness that disaster education should move beyond awareness-raising to competency-based education, ensuring that students acquire practical skills applicable in real disaster scenarios.

In the literature, disaster literacy is mostly addressed in the context of knowledge level, awareness and attitude; however, there are limited studies on structuring this concept with a skill-based approach. In particular, the lack of holistic frameworks regarding which concrete skills are needed in different stages of the disaster (before, during, after) is striking [13,15,16]. Moreover, the fact that many models developed for disaster literacy are designed independently of the cultural context limits the applicability of these frameworks in different geographies. Given the increasing frequency of large-scale disasters and the limited effectiveness of knowledge-based disaster education programs, frameworks that emphasize applicable skills are urgently needed. Without such skills-focused approaches, communities remain vulnerable even if they possess theoretical knowledge.

This study aims to address disaster literacy with a skills-based and culturally contextualized approach. In the first phase of the study, 33 skills related to disaster literacy were identified

through qualitative interviews conducted with 20 earthquake survivors and 19 search and rescue workers following the 2023 Turkey earthquakes. In the second phase, these skills were presented to 20 experts working in the field of disaster management in the United States and revised in light of the written feedback received from 12 experts. In this context, the aim of the study is to present a comprehensive, applicable, and cross-culturally valid skill framework for disaster literacy. This framework not only provides an academic contribution; it is also considered a functional and scalable tool in the fields of disaster education, policy making, and community resilience.

The purpose of this study is to identify, develop, and evaluate the cross-cultural validity of the core disaster literacy skills that individuals and societies need to possess in disaster preparedness, response, and recovery processes. The skill set, based on qualitative data obtained from disaster victims and search and rescue teams following the 2023 earthquakes in Turkey, was then finalized after being evaluated with expert opinions from the United States. This research aims to develop a universal framework that can inform educational curricula and community resilience strategies based on a skills-based disaster literacy approach. To this end, the following questions were addressed:

- What are the core skills needed by individuals and societies in the pre-, during-, and post-disaster phases?
- How can a disaster literacy skill framework be adapted to different cultural contexts?
- What are the perspectives of disaster science experts on the feasibility and applicability of the proposed skill set?

Method

This research followed a two-stage qualitative methodology to develop a skill-based disaster literacy framework. In the first stage, core skills were identified through semi-structured interviews with disaster survivors [11] and search-and-rescue professionals affected by the 2023 Turkey earthquakes [15]. In the second stage, the proposed skill set was presented to experts in the broad disaster field in the United States. Based on structured written feedback, the framework was revised to enhance clarity, feasibility, and cross-cultural applicability. This design aims to transform locally grounded data into a model with international relevance.

Research design

The study utilized a two-stage qualitative design. The first stage focused on identifying disaster literacy skills through interviews with earthquake survivors and frontline responders in Turkey. The second stage involved a written consultation process with 20 U.S.-based disaster experts. Although the feedback process was inspired by the Delphi technique, it remained qualitative in nature, focusing on expert judgment and iterative refinement rather than quantitative consensus.

Phase one: skill identification process in Turkey

In this phase, two stakeholder groups directly affected by the 2023 earthquakes in Turkey were studied:

- 20 earthquake survivor,
- 19 search and rescue expert firefighters (from the Izmir Metropolitan Municipality Fire

Department).

The initial framework was constructed based on qualitative data from earthquake survivors and firefighters in Turkey, as these groups represent both directly affected citizens and professional first responders with firsthand disaster management experience. The survivors offer insights into their experiences of vulnerability, coping, and resilience during the 2023 Turkey earthquakes, while the firefighters offer perspectives on the technical and organizational skills required for response and recovery. Bringing together these perspectives allowed the framework to reflect both community-based and professional dimensions of disaster literacy.

In the first phase, semi-structured interview protocols were developed in line with the study's research questions. The protocols were developed based on previous research on disaster literacy skills [11,15]. and included items covering pre-disaster preparation, steps to be taken during a disaster, and post-disaster recovery. The interview questions were pilot-tested with two participants and updated for clarity and relevance before being administered to the entire sample.

Participants were recruited through local community organizations and municipal coordination centers in Hatay, one of the provinces most affected by the 2023 earthquakes. Inclusion criteria were direct earthquake experience and age 18 or older. Firefighters were specifically selected from the Izmir Metropolitan Municipality Fire Department due to their extensive experience in urban search and rescue operations. This purposive sampling strategy ensured that participants had relevant and diverse disaster experiences.

Data were collected through face-to-face interviews and structured anonymous group studies known as the "storage method". With this method, participants freely expressed their individual contributions, and then these contributions were classified thematically within the group.

As a result of this phase, a preliminary framework of 33 skills was created, divided into 3 phases: before, during and after the disaster.

Phase two: revision with expert feedback in the USA (Delphi inspired)

The second phase involved validating the identified skills with 20 international disaster experts, the majority from the United States. This group was selected for their professional expertise and the maturity of disaster management practices in the United States, providing a benchmark for cross-cultural applicability. Written feedback was sought through structured assessment forms focusing on the clarity, applicability, and cultural compatibility of the proposed skills. This process allowed for the refinement of the framework and ensured its broader validity beyond the Turkish context.

The first skill set that was created was sent in writing to 20 experts working in the disaster field in the USA. 12 of these experts provided detailed feedback. In line with the feedback;

- Some skill expressions were simplified or restructured,
- New skills were added (e.g., digital literacy, psychological first aid, community coordination),
- The number of skills was increased from 33 to 35.

The model created as a result of this process was named "Revised Basic Disaster Literacy Skills Framework Determined" and became an educational tool based on both local reality and international adaptability.

Findings

This study differs from previous research in three main ways. (I) While previous studies on

disaster literacy largely emphasize knowledge, awareness, or attitudes (e.g., (1,4)), this research presents a structured, skills-based framework that transforms disaster literacy into concrete and actionable competencies across all disaster phases. (II) Unlike previous studies, which are mostly limited to single contexts, this study demonstrates the cross-cultural applicability of the proposed framework by combining insights from disaster victims and first responders in Turkey with validation by international experts. (III) Finally, this study expands the scope of disaster literacy by incorporating emerging areas such as digital information validation, psychosocial resilience, and community coordination, positioning the framework as a comprehensive and interdisciplinary contribution to disaster education and policy. In this context, this section presents the findings regarding the analysis of the obtained qualitative data and the skills development process.

Initial skill set obtained from interviews and group studies in Turkey

In this study conducted after the 2023 earthquakes in Turkey, qualitative data was collected with participants from two different groups in order to define basic skills related to disaster literacy. Participants:

- 20 earthquake survivors who directly experienced the disaster,
- 19 firefighters and search and rescue experts who actively worked in the field.

Findings obtained from earthquake survivors

The interviews revealed that the earthquake survivors' pre-disaster preparedness levels were quite limited. Participants:

- They stated that they did not have emergency plans at home,
- They did not develop a method to communicate with their family members in the event of a disaster,
- They did not have a disaster kit, and
- They had limited and delayed interactions with the media, social environment or public institutions in terms of accessing information.

These statements have shown that the lack of pre-disaster preparation directly reflects on behaviors and safety during the disaster.

Feedback from firefighters and search and rescue experts

Firefighters stated that especially in the first hours of the intervention, citizens:

- Not having basic rescue and first aid skills,
- Making wrong evacuation decisions,
- Not being able to communicate seriously hindered the coordination of the teams and the speed of the response.

In addition, issues such as the public not knowing the post-disaster gathering areas and the lack of organization of voluntary aid initiatives are also prominent deficiencies.

Formation of the initial skill set

In light of all these qualitative findings, the skills were grouped into three main phases:

- Before the disaster,
- During the disaster,
- After the disaster.

The basic disaster literacy skills set created in this first phase consisted of a total of 33 items. Skill statements were derived directly from participant opinions and were simplified and structured. This set was then evaluated and revised with international expert opinion.

Feedback from USA experts

The 33-item skill set, which was created as a result of the field study conducted with earthquake survivors and firefighters in Turkey, was sent to 20 experts working in the disaster field in the USA in the second stage. 12 of these experts provided detailed written feedback and made suggestions regarding the content, applicability and cultural context of the skills.

As a result of the content analysis, these feedbacks were gathered under four main themes: Clarity of expression, practical feasibility, universality and ınclusiveness, and organizational alignment.

Clarity of expression

Experts stated that some skill expressions were presented as tasks or actions, and therefore needed to be reframed in terms of the concept of "skill". For example:

"Buying insurance or maintaining extra food and water is, for example, an action… not a skill." (T.W.)

Accordingly, instead of "getting insurance," expressions that include decision-making and implementation competencies such as "assessing risks and choosing the right policy" were suggested. In light of this feedback, the framework:

- Actions have been transformed into decision-making skills,
- An approach focused on not just knowing the information but being able to apply it has been adopted.

Practical feasibility

Some experts have emphasized the importance of defining more clearly how the skills will be applied in real disaster scenarios. For example:

"I think they are skewed toward short-term disaster relief, rather than the long-term recovery." (A.T.)

In line with this view, the framework has included:

- "Stress management in long-term recovery processes,"
- "Participation in community-based reconstruction," and other skills specific to the recovery phase.

In addition, some experts have suggested that skill statements be supported with more concrete examples.

Universality and inclusiveness

Another theme frequently highlighted in feedback was the lack of skills that are transferable across different types of disasters, such as digital literacy, financial literacy, and psychological

preparedness:

"Digital literacy… financial literacy… are transferable across different types of disasters." (J.T.)

"Consider that 'communication' can be verbal, visual, or alternative, especially for neurodiverse individuals." (A.D.)

Accordingly, the following additions were made to the framework:

- Digital information verification,
- Financial preparedness and insurance assessment,
- Psychological first aid,
- Communication inclusiveness (e.g., sign language, text messaging) were included.

Organizational alignment

Some experts suggested that individual skills should be considered in collaboration with community-based disaster management and professional response teams:

"Collaborates with local response teams and community members to organize relief efforts." (A.W.)

In line with this suggestion, the following skills were added to the framework:

- Voluntary participation,
- Sharing information with neighbors,
- Coordination with professional teams, and collective resilience-focused skills.

Revision of the skills framework

As a result of the restructuring process carried out within the framework of these four main themes:

- Some skill expressions were simplified or conceptually combined,
- The initial list of 33 items was transformed into a new and improved skill set of 35 items.

The new framework was structured according to the three phases of the disaster (before, during, after), and became a content that is both locally appropriate and internationally valid.

Scope of skill set

The new framework covers preparedness, response, recovery skills:

- Preparation: digital verification, emergency planning, psychological preparedness,
- Response: alternative communication channels, safe evacuation decisions, teamwork,
- Recovery: psychological first aid, accurate information sharing, community-based reconstruction.

Discussion

In this section, the relationship between the findings and the literature, their cross-cultural dimensions, and their contributions to practice are discussed. This study addresses disaster literacy as a multi-layered competency framework that does not reduce disaster literacy to just individual knowledge; it includes psychosocial, digital, and social dimensions. The skill set developed as a result of interviews with earthquake survivors and firefighters in Turkey has reached cross-cultural validity and universal applicability with the contributions of disaster experts from the USA. The discussion section discusses the literature equivalents and original

contributions of this framework.

One of the most striking aspects of the research findings is that they reveal the critical role played by individuals and the immediate environment in conditions where professional response teams have limited access in the first hours of a disaster. This clearly demonstrates the need for a preparedness approach based not only on institutional response capacity but also on community response and first aid skills in disaster management. Karacaoğlu [15] emphasizes that basic first aid, communication and organization skills of individuals are of vital importance in regions where search and rescue teams cannot reach. Similarly, Albayrak-Aydemir [17] attributes the success of disaster management to the active participation of the community and considers this participation as a prerequisite. Whittaker et al. [18] draw attention to the increasing phenomenon of "digital volunteering" with the spread of digital communication technologies, and state that cultural norms and legal liability limits are the main obstacles to the effective participation of informal volunteers in disaster response. The authors argue for the need for more inclusive and flexible emergency management models in order to effectively mobilize existing local capacity and resilience.

In community-based disaster preparedness, the role of not only adults but also children should not be ignored. Peek [9] demonstrates that children have the capacity to actively contribute to disaster preparedness, response and recovery processes; she argues that in order to increase children's resilience against disasters, their access to resources should be ensured, their participation should be encouraged and equitable support mechanisms should be developed. Similarly, Mutch [19] discusses the potential of schools to support communities before, during and after disasters, drawing attention to the role of educational institutions in building social capital and social resilience. Mutch [19] emphasizes that this role should be made more visible in local and national disaster policies. On the other hand, some studies also draw attention to situations where volunteer participation after a disaster is not sufficiently integrated with professional teams. Daddoust et al. [20] reported that in post-disaster reviews, emergency management personnel often lack sufficient preparation on how to effectively communicate with and coordinate volunteers. It is stated that this situation can create additional burdens and risks for emergency response organizations that are already working under intense pressure. Community-based education stands out as the most sustainable way to reduce these risks and use volunteer capacity effectively. As Tupper & Karacaoğlu [16] state, disaster education should include not only the transfer of information, but also values such as civic responsibility, critical thinking, social justice and resilience. In this context, disaster literacy should be considered as a strategic tool in building social resilience, beyond being an individual competence area. Equipping community members with basic intervention, communication and solidarity skills plays a direct decisive role in reducing the effects of disaster.

Post-disaster communication and information flow are becoming increasingly determinant in digital media environments. Field observations regarding the 2023 Turkey earthquake have once again revealed the role of digital tools and access to information in effective disaster management. Especially the rapidly spreading misinformation and disinformation on social media increases the risks of panic, insecurity and misdirection at both the individual and society level. This situation necessitates that digital and media literacy be considered as a central competence area in disaster preparedness and response processes. Aldamen & Abdul Jaleel [21] emphasize that social media is not only a communication tool but also an innovative platform for documenting disaster experiences and building collective memory. Therefore, including digital information verification, media content evaluation, access to reliable sources and disinformation skills in the disaster literacy framework is a recommended approach at both local and global

levels. Karacaoğlu & Özkaya [22] discuss how social media, television, and radio can be used strategically for effective information transfer in times of crisis, particularly by pointing out the role of scientists and academic institutions in disaster communication. Similarly, Karacaoğlu & Güner [23] state that access to reliable information plays a vital role in guiding the public and strengthening psychosocial resilience in post-disaster recovery processes. Obar [24] suggests that practices such as digital citizenship and source triangulation should be supported through education in combating misinformation; he defines the development of fair digital participation opportunities and media critique skills as a critical goal for democratic societies. The author argues that international digital participation initiatives should not only focus on access, but also on developing the ability to evaluate content and distinguish right from wrong. In light of these findings, it can be said that digital information literacy should not be considered as an add-on, but rather as a fundamental component of disaster preparedness in disaster literacy pedagogy. Digital verification, media critique, and questioning of information sources skills have become indispensable tools for building disaster-resilient individuals and societies.

Various studies have shown that individuals experience serious effects not only physically but also emotionally and psychologically in the post-disaster period. In the interviews conducted within the scope of this research, earthquake victims in particular clearly expressed the need to cope with the emotional fragility, stress and loneliness that emerged after the disaster. These findings reveal that psychological support should be a central element in post-disaster recovery processes. Karacaoğlu and Güner [23] have shown that disasters are not limited to physical damage; they also deeply affect the emotional, social and cognitive functioning of individuals. Therefore, disaster literacy should include not only emergency response and preparedness skills, but also skills aimed at strengthening the psychological resilience of the individual. In this direction, skills such as "psychological first aid", "emotional preparation" and "establishing community-based support systems" were included in the revised framework developed.

The literature also supports this orientation. Psychological recovery after a disaster is as important as physical recovery and is a determining factor in regaining social functionality [25]. Similarly, Sim & Wang [26] draw attention to the importance of activating psychological support structures early against the long-term effects of post-traumatic stress. Wang et al. [27] argue that personnel working in disaster response should be competent not only in technical skills but also in psychological first aid. Fatoni et al.'s [28] study showed that, in addition to first aid training, training programs focusing on psychological factors that inhibit helping behavior have the potential to increase individuals' helping behavior during a disaster. It has been shown that such programs significantly affect post-disaster helping behavior by increasing both technical knowledge and psychological preparedness. In this context, integrating psychological resilience-focused skills into the disaster literacy framework strengthens not only individuals' preparedness for disasters but also their post-disaster recovery capacity.

Another notable finding of the study is that disaster literacy can be integrated with technology-supported learning approaches. Digital learning platforms, mobile applications, and personalized learning environments based on artificial intelligence have the potential to integrate disaster education into the lifelong learning process, not just the classroom environment. In this respect, disaster literacy can make individuals' disaster preparedness capacities more accessible and sustainable by being supported by innovative tools developed in the field of educational technologies. Artificial intelligence-supported applications, especially when combined with virtual reality (VR), 3D modeling, gamification, and simulation-based learning techniques, offer learners experiential learning opportunities and accelerate the process of transforming

conceptual knowledge into behavior [29]. These technologies can strengthen individuals' ability to make the right decisions in times of crisis by ensuring that disaster scenarios are experienced safely.

Karacaoğlu et al. [13] developed artificial intelligence-based text classification and question-answer systems for disaster literacy education and demonstrated that these approaches can be used as effective digital tools for individuals to acquire disaster preparedness skills. Text classification supports focused learning processes by defining the thematic structure in learning materials; question-answer systems enrich the learning experience through automatic information extraction from texts, and it is emphasized that application areas that include large data sets, more complex modeling, and different scenarios suitable for the real world should be developed. In particular, factors such as the selection of pre-trained models, data cleaning, labeling consistency, and hyperparameter settings directly affect the accuracy and effectiveness of artificial intelligence applications. In this context, pedagogical suitability should be taken into consideration as much as algorithmic optimization. Liu et al. [30] also stated that multilingual mobile platforms and VR-based learning tools provide significant contributions in the context of disaster education. In this context, this study, which addresses disaster literacy together with digital transformation processes, is one of the limited examples in the literature. As a result, the integration of technological tools into disaster education not only increases knowledge transfer but also the active participation, motivation and problem-solving skills of individuals, making disaster literacy more functional.

This study on disaster literacy skills is not limited to the discipline of disaster management; it is also addressed with an integrated approach with fields such as pedagogy, communication, digital education technologies and psychology. In this respect, the research offers a meaningful response to the criticisms in the literature that disaster education is often confined to the narrow framework of technical disciplines. As Andharia [31] stated, how disasters are scientifically conceptualized is directly related to the academic level, disciplinary background, perception capacity and pedagogical framework of the observer. Selby & Kagawa [32] also revealed that technically focused narratives that neglect the environmental and social dimensions of disaster education are insufficient to develop a holistic disaster awareness in students. In this context, the skill-based disaster literacy framework presented by this research provides an interdisciplinary reference point not only for field practitioners but also for educators and policy makers. The framework, structured from the perspective of educational sciences, is consistent with the principles of lifelong learning, and also includes social dimensions of disaster education such as civil defense, citizenship awareness, and social resilience [10].

Another prominent contribution of the study is that the skill set created through field research conducted at the local level (Turkey) has been approved in terms of content and applicability by experts in countries with different disaster experiences. This framework, revised with the contribution of disaster field experts in the USA, offers a strong structure in terms of both contextual validity and cross-cultural transferability. As a result, disaster literacy is not only a learning area that shapes individual behaviors, but also a strategic intervention tool that enables societies to build a systematic and sustainable resilience capacity against disasters. In this respect, the skill-based approach presented provides a qualified contribution to both scientific literature and practice by creating an interdisciplinary knowledge production ground.

This study addressed three primary research questions regarding the identification, cross-cultural validity, and pedagogical applicability of disaster literacy skills. Findings demonstrated that the skill set developed from field data in Turkey was significantly validated and expanded through international expert consultation. This supports the universal validity of a skills-based

approach to disaster literacy across diverse contexts.

Conclusion and Implications

This study aims to develop a skill-based approach that takes disaster literacy far beyond the level of knowledge and enables individuals and societies to act effectively before, during and after a disaster. The first skill set, which was created based on the experiences of 20 earthquake victims and 19 firefighters in the field study conducted after the 2023 earthquakes in Turkey, was structured according to the three basic stages of the disaster. This set has a high level of contextual validity in terms of both being informed by real-life experiences and being based on expert opinions working in the field.

In the second stage of the study, the skill set was tested contextually and culturally with written consultation received from 20 experts working in the field of disaster management and education in the USA. In the light of structured feedback from 12 experts, the framework was reorganized; conceptual clarity was increased, applicability was strengthened, digital and psychosocial areas were expanded and cross-cultural adaptability was ensured. As a result, a revised framework consisting of a total of 35 skills for each stage of the disaster was presented (See Appendix A). This skill set is not only an educational tool, but also offers a holistic approach that will reduce disaster risk, increase social resilience, and enable individuals to take an active role in times of disaster.

As a conceptual innovation in the field of disaster education, this study provides a scientific basis that will guide curriculum development, citizen education, and the design of digital learning systems based on a skill-based approach. This research proposes a model that can be used not only locally but also universally by addressing disaster literacy with its pedagogical, cultural, and technological dimensions. In the following process, it is recommended that this skill set be measurable, tested in different countries and disaster types, and integrated into digital learning environments.

This research shows that disaster literacy should be developed not only with knowledge but also with multifaceted skills such as decision-making, implementation, digital competence and psychosocial resilience. In this direction:

- Disaster literacy should be integrated into the lifelong learning system starting from the K–12 level; educational content should be supported not only with theory but also with practical activities and real-life scenarios.
- Skills such as psychological first aid, emotional resilience and communication during crisis should be prioritized in disaster education.
- Digital literacy should be included in the education curriculum together with information verification and secure communication skills on social media.
- Artificial intelligence and digital platforms should be used to provide personalized learning, accessibility and simulation-based experiences in disaster education.
- The revised skill framework should be tested in different countries, disaster types and cultural contexts; adaptable versions should be developed together with local stakeholders and disseminated through multi-stakeholder collaborations.

These implications demonstrate that disaster literacy should not remain at the knowledge level but should be institutionalized as a skills-based, interdisciplinary, and globally adaptable

approach. Future research should focus on testing this framework in different contexts to strengthen its universality and impact.

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Appendix A. Revised framework of basic disaster literacy skills

Pre-disaster skills
1. Assesses home safety and reinforces structures to mitigate disaster risks.
2. Develops an emergency preparedness plan for family and community coordination.
3. Secures household items to minimize injury risks.
4. Knows how to locate, interpret, and act upon disaster warnings and alerts.
5. Understands financial preparedness (e.g., insurance coverage, emergency savings, disaster loans).
6. Prepares emergency supplies (go-bag, first aid kits, water, food, medications, fuel, and power sources).
7. Practices first aid and basic rescue skills to assist oneself and others.
8. Develops and practices a family communication plan in case of service disruptions.
9. Maintains digital literacy skills to verify and interpret emergency information from reliable sources.
10. Participates in disaster drills to build muscle memory for emergency responses.
11. Knows how to shut off utilities (gas, water, electricity) safely before or after a disaster.
12. Understands community emergency resources (shelters, aid organizations, response teams).
13. Prepares for potable water and wastewater outages by knowing alternative sources and solutions.
14. Prepares for mobility limitations by having alternative evacuation and transportation plans.
15. Trains in psychological first aid and emotional preparedness to support self and others.
16. Understands how to use fire extinguishers and other safety equipment in emergencies.
During-disaster skills
1. Maintains composure under pressure and makes quick, informed decisions.
2. Identifies the safest evacuation routes and sheltering areas based on the type of disaster.
3. Uses multiple communication methods (radio, SMS, social media, direct calls) to stay informed, listen to responders, and reach others.
4. Applies first aid, CPR, and rescue techniques to assist injured individuals.
5. Adapts to changing conditions and modifies plans based on the evolving disaster scenario.
6. Uses alternative communication methods when networks fail (e.g., signaling, written messages, HAM radio).
7. Coordinates with neighbors and community members to assist in group evacuation or sheltering.
8. Ensures the safety of vulnerable populations (elderly, children, individuals with disabilities).
9. Demonstrates effective problem-solving and teamwork in high-stress situations.
Post-disaster skills
1. Provides emotional support and psychological first aid to affected individuals.
2. Gathers damage and impact data to assist local authorities in recovery planning.
3. Accesses and applies disaster relief resources (government aid, community support, financial assistance).
4. Supports and collaborates with professional response teams in recovery efforts.
5. Shares accurate disaster-related information to prevent misinformation and panic.
6. Participates in rebuilding, mitigation, and recovery planning for long-term community resilience.
7. Checks on neighbors and vulnerable individuals' post-disaster.
8. Manages stress and emotional resilience to navigate long-term disruptions.
9. Practices adaptability and innovation in using available resources when infrastructure is damaged.
10. Contributes to a culture of preparedness by educating others and sharing lessons learned.

SMS, short message service; CPR, cardiopulmonary resuscitation; HAM, amateur radio.