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# A Study on the Design of GENSAI Products for Disaster Preparedness

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## Abstract

*Natural disasters, an unavoidable part of human life, are increasing in both frequency and diversity, posing a major challenge to achieving sustainable development. Due to its geographical and geological characteristics, Iran is among the ten most disaster-prone countries in the world. For decades, strategies such as crisis management, public education, and architectural planning have been implemented to reduce the impact of these events. However, the role of product design, from risk identification to emergency response and post-disaster recovery, remains a crucial yet less explored dimension. The aim of this study is to examine product design strategies that minimize damage caused by natural disasters and to evaluate design ideas developed to address these critical challenges. The study's research questions were as follows: 1. How do GENSAI design concepts from Iran and Japan differ and/or are alike through their product(s) types, how they function, and their cultural adaptations? 2. What criteria could be developed to assess whether student-developed GENSAI design concepts were effective? 3. How could the use of a comparative analysis help to inform how to establish a foundation for a GENSAI design framework that could be adapted for any culturally diverse context? Because Japan is a pioneer in GENSAI-oriented design and has produced numerous products for disaster preparedness, workshops conducted in Japan, as well as a parallel workshop held in Iran by the authors, were selected as case studies. This study draws upon existing literature, including documents, books, essays, and articles, alongside workshop implementation and project analysis. The study employed a comparative design-research approach, integrating workshop-based inquiry, comparative thematic analysis, expert review and framework synthesis. Workshop outputs were analyzed using a multi-stage coding process and comparative thematic analysis. The results indicate that designing products based on the GENSAI approach can play a significant role in reducing the impacts of natural disasters. The results of combining and comparing Iranian and Japanese students' responses were that they produced notably different but culturally relevant designs. Within these two workshops, Iranian concepts tended to emphasize multifunctional carriers, whereas Japanese concepts more often featured compact, personal-care items — patterns best read as context-dependent observations from a small, exploratory sample rather than as general cultural differences. The rationale of these principles and criteria founded the basis of a proposed Preliminary GENSAI Design Framework that could promote 'everyday resilience'. The preliminary GENSAI Design Framework is comprised of three layers (i.e. founding principles, design strategies & evaluation checklist). These design strategies offer practical, culturally adaptable solutions that strengthen preparedness and resilience in disaster-prone communities.*

## Keywords

*Product Design, GENSAI Approach, Natural Disasters, Disaster Preparedness, Students' Ideas, Comparative Design Analysis, Design Framework.*

# Introduction

In today's world, the importance of disaster risk reduction continues to grow, particularly in the context of sustainable development. As recognized by the Sendai Framework for Disaster Risk Reduction 2015-2030, the role of science, technology, and innovation—including design—is catalytic and boundary-breaking in reducing disaster risks (UNISDR, 2015). There are three primary reasons why mitigating disaster risks has become increasingly critical. First, despite technological advancements, human exposure to natural hazards, such as earthquakes, floods, landslides, and tsunamis, remains significant. These events continue to pose major challenges to human civilization. Moreover, the frequency and severity of hazards such as floods, droughts, and landslides have intensified due to global warming and climate change. While developing countries have made some progress in reducing human losses, both developing and developed nations have experienced rising human and economic tolls in recent years. Comparing disaster data from 1973 to 2000, the number of natural hazard-related disasters has doubled each decade. Although mortality rates have decreased in the last decade compared to previous ones, the number of affected individuals and the scale of economic losses have increased substantially (UNISDR, 2005).

Second, the growing importance of disaster risk reduction is based on the concentration of risks that has taken place historically, especially in developing countries, as a consequence of inappropriate development practices. As the 2004 United Nations Development Program report states, “Although only 11 per cent of people exposed to natural hazards are in countries with low human development, more than 53 per cent of total disaster-related mortality occurs in these countries” (UNDP, 2004).

Thirdly, there have been new threats such as gun violence, terrorism, and other man-made disasters. With the growing public attention to both natural and man-made disasters, product design has achieved significant progress in controlling and mitigating disaster impacts. Japan, in particular, has expanded the GENSAI approach, providing innovative frameworks for designing products that enhance disaster resilience. The Japanese culture of bōsai (preparedness as part of everyday routine life) offers an exemplary model for understanding how design could also help integrate disaster preparedness into daily routines (Kitagawa, 2019).

This raises the question of how GENSAI-based product design can be applied in Iran to reduce disaster impacts and develop effective mitigation strategies. This research hypothesizes that the GENSAI approach can be used to design more resilient products capable of managing catastrophic damage during disasters. This study aims to explore and analyze the GENSAI approach in product design by examining student projects from two countries, Iran and Japan. The research will be supported by the following three main questions:

- **RQ1**: How do students’ concepts for GENSAI in both countries have similar and different features (e.g., types of products they created, intended purposes for those products, and how they incorporate the culture of each country)?
- **RQ2**: What criteria can be developed to evaluate how effective the GENSAI products created by each student will be?
- **RQ3**: How can the analysis of the GENSAI concepts created by all students help lead to the development of an initial GENSAI design framework that can be applied in different countries and regions?

To achieve this, two workshops were conducted: one at Kobe Design University in Japan and another at the University of Tehran in Iran, providing practical insights into the application of GENSAI principles in disaster preparedness.

**Theoretical Positioning and Research Gap:**

This study sits at the intersection of four streams of design scholarship. Resilience-oriented design has established that products, systems, and services should retain their core functions under disruption (Guo et al., 2023), but it largely addresses engineering performance rather than the cultural uptake of preparedness.

Preparedness and everyday-life-preparedness research — notably the Japanese notions of bōsai and GENSAI — has shown that readiness is most durable when embedded in daily routines (Kitagawa, 2019; Mazereeuw, 2025), yet it is predominantly grounded in the Japanese context. Disaster-oriented product design has produced concrete artefacts and competition catalogues of preparedness products, but these are rarely traced back to the design principles that generated them. Finally, cross-cultural design research argues that design capability is universal while its expression is locally situated (Nakano & Yamori, 2024). What remains largely unexamined across these literatures is how the GENSAI principles are interpreted and translated into concrete design concepts when the same brief is delivered in different cultural and educational settings, and whether such cross-cultural comparison can be consolidated into an adaptable, transferable framework. The present study advances existing knowledge on two fronts: (i) it provides a structured, criterion-based comparison of how Iranian and Japanese design students operationalize GENSAI principles — extending an earlier exploratory comparison (Farzam & Allahdadi, 2017) from descriptive observation to a coded analytical synthesis — and (ii) it abstracts the recurring patterns of that comparison into a three-layer GENSAI Design Framework intended for adaptation beyond the two studied contexts. It thereby connects the principle-level discourse of GENSAI with the artefact-level concerns of disaster-oriented product design, within a cross-cultural frame. In this respect, the study contributes not only to GENSAI scholarship but also to the broader literature on resilience-oriented and preparedness-oriented design by demonstrating how preparedness principles can be translated into culturally situated product concepts.

# Methodology

In this study, the research methodology was determined based on the study's objectives: it is practical in terms of purpose and analytic-descriptive in terms of approach. Data were collected using document analysis (library research) and survey methods. Additionally, to explore and evaluate GENSAI-based product designs, two workshops were conducted as case studies in Iran and Japan, focusing on the impact of GENSAI product design on disaster management. The research is descriptive in terms of data collection, as it relied on surveys of experts to gather information and analyze the underlying hypotheses. The study was conducted in a comparative design-research approach combining document analysis, workshop-based inquiry, and a comparative evaluation of design outcomes. The workshops were not used solely as educational activities; rather, they functioned as structured research environments through which design concepts were generated, documented, and subsequently analyzed. The research process consisted of four sequential stages: (1) literature review and conceptual framing, (2) workshop implementation in Iran and Japan, (3) comparative analysis of the resulting design concepts, and (4) synthesis of findings into a preliminary GENSAI Design Framework.

All four phases of the workshop process were incorporated into the design of the workshops as established in a previous study on workshop-based research (adapted from business research methods). Having a systematic way of conducting a workshop gives the researcher assurance that they can be used as valid and reliable research instruments and not simply as a means of providing instruction to participants. Specifics regarding each workshop methodology can be found in Table 1.

**Table 1:** *Methodological Specifications of Research Workshops.*

| *Methodological Aspect* | Iran Workshop (University of Tehran) | Japan Workshop (Kobe Design University) |
|---|---|---|
| *Number of Participants* | 22 graduate industrial design students | 18 undergraduate and graduate design students |
| *Sampling Method* | Purposive sampling: students who completed the "Design for Sustainability" course | Voluntary sampling: students interested in disaster design |
| *Duration* | 3 days (18 hours total) | 2 days (14 hours total) |
| *Workshop Activities* | Lectures, case study analysis, individual and group ideation, final presentations | Lectures, case study analysis, individual and group ideation, final presentations (with greater emphasis on physical prototyping) |

| | | |
|---|---|---|
| *Data Collection Instruments* | Design outputs (sketches, posters), semi-structured questionnaires, field notes | Design outputs (sketches, prototypes), video recordings of final presentations, and observational notes |
| *Evaluation Criteria* | Dual-use functionality, innovation, cultural adaptability, and feasibility (see Section on Analysis) | Dual-use functionality, innovation, cultural adaptability, and feasibility (see Section on Analysis) |
| *Instructors/Facilitators* | Dr. R. Farzam | Dr. R. Farzam and Dr. J. Sagara |

This transparent documentation of workshop methodology addresses recent calls in design research for greater rigor in practice-based and workshop-based studies, where "*how design choices influence the research practice and research results*" must be made explicit (Kitagawa, 2019). For the purposes of analysis, the primary unit of analysis was the design concept rather than the individual participant. Across the two workshops, participants generated multiple design concepts during the ideation process. A total of 68 design concepts were included in the comparative analysis, comprising 40 concepts from the Iranian workshop and 28 concepts from the Japanese workshop. The category frequencies reported in the comparative analysis were derived solely from coding the 68 workshop concepts (40 Iranian, 28 Japanese). They are independent of the GDPC2016 competition data (Appendix B), which did not enter the coded dataset; any resemblance between the two should not be read as continuity of evidence.

**Table 2:** *Expert Evaluation Protocol.*

| Component | Description |
|---|---|
| Number of Evaluators | 3 |
| Areas of Expertise | Industrial Design, Disaster Preparedness, Design Education |
| Evaluation Material | Workshop-generated design concepts |
| Evaluation Method | Independent review followed by consensus discussion |
| Rating Scale | 1–5 |
| Assessment Criteria | Innovation, Feasibility, Cultural Adaptability, Alignment with GENSAI Principles |
| Anonymization | Proposal descriptions reviewed without identifying participant information |

The expert evaluation was not intended to produce definitive performance measures but rather to provide a structured and transparent basis for comparing conceptual design proposals. The evaluation, therefore, functioned as a supplementary analytical procedure alongside the thematic comparison of workshop outcomes. For descriptive purposes, expert ratings were summarized using mean scores and standard deviations across the evaluated concepts. These descriptive statistics were used only to support qualitative comparison between groups and were not intended as evidence of statistical significance or generalizable differences.

Analysis of workshop outputs was conducted through a multi-stage coding procedure. In the first stage, all design concepts were reviewed and documented against their main function, user group, and disaster preparedness strategy. In the second phase, recurring themes and design features were identified and categorized into larger analytical categories. The third stage was comparative thematic analysis, which aimed to investigate the similarities and differences between the concepts in Iran and Japan. To increase the consistency of analysis, coding decisions were reviewed independently by two researchers and then discussed until consensus was achieved on the definitions of categories and interpretation.

**Researcher Role and Reflexivity:** The researchers were not neutral observers but active participants in the research process: they designed both workshop briefs, facilitated the sessions, and subsequently coded and interpreted the resulting concepts. This dual role has two implications that must be made explicit. First, facilitation shaped the solution space: by framing the brief around the four disaster-ready criteria and by selecting the case studies presented, the facilitators inevitably oriented participants toward certain kinds of

solutions, so the generated concepts should be read as responses to a guided brief rather than as unprompted cultural expressions. Second, facilitation was asymmetric across sites — the Iranian workshop was led by one author, whereas the Japanese workshop was co-facilitated with a local instructor — so cross-site differences may partly reflect differences in facilitation and instructional emphasis rather than participant culture alone. To limit interpretive bias arising from the author's involvement, coding decisions were independently double-coded and reconciled by consensus, and the expert panel reviewed anonymized proposals without knowledge of national origin where possible. These measures reduce but do not eliminate the influence of researcher involvement, and the findings should be read with this reflexive caveat in mind.

The comparative results in Table 4 were obtained using the coding framework and expert evaluation process described in the methodology section. The table, therefore, represents an interpretive synthesis of recurring patterns observed across the analyzed design concepts rather than statistically generalizable findings.

**Table 3:** *Analytical Coding Structure Used for Comparative Analysis.*

| Analytical Dimension | Coding Categories | Purpose of Analysis |
|---|---|---|
| Product Type | Bag, First-aid, Shelter, Lighting, Communication, Furniture, Others | Identification of dominant preparedness solutions |
| Intended User Scale | Individual, Family, Community | Examination of preparedness orientation |
| Functional Strategy | Additive, Integrated, Transformable | Evaluation of dual-use implementation |
| Disaster Function | Protection, Rescue, Communication, Survival Support | Assessment of preparedness role |
| Cultural Adaptation | Material, Form, Usage Pattern, Symbolic Reference | Examination of contextual adaptation |

Table 3 presents the analytical dimensions used in the coding process. These dimensions were derived from the study objectives, principles of GENSAI design and recurring characteristics found across workshop outputs. The coding framework was not a strict classification system but an analytical tool to help ensure consistency in comparison.

## *The Natural Disasters of the World: Iran and Japan*

Natural hazards are increasing worldwide. Among these events, earthquakes cause the highest number of casualties, followed by storms, extreme heat, tropical cyclones, and floods. Many of these hazards are exacerbated by climate change and unsustainable human interventions in the environment and natural resources.

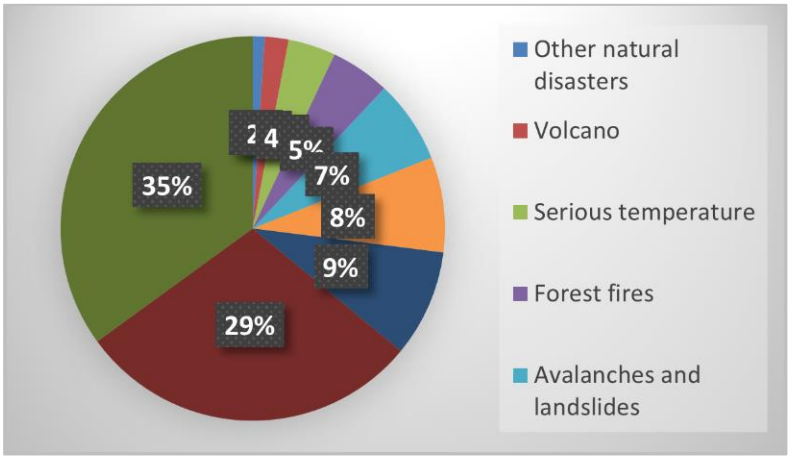


**Figure 1:** *Illustrates the global distribution and percentage of natural disaster occurrences.*

According to statistics from the United Nations Development Program (UNDP) and the Centre for the Study of the World's Natural Disasters, two-thirds of the economic damages from natural disasters occur in densely populated countries, particularly in Asia. Among these regions, South Asia is considered the

most at-risk area, reporting the highest number of casualties from earthquakes, seasonal storms, floods, droughts, and other hazards. Population growth, especially rapid urbanization, is a major factor contributing to human losses during natural disasters. South Asia, being the most densely populated urban region in Asia, is particularly vulnerable to such catastrophes. Although several initiatives, including the Asian Urban Disaster Risk Management Program (AUDMP), have been implemented to manage urban population risks, many areas in Asia still require comprehensive programs to reduce vulnerability and manage urban concentration effectively (Khosh Sokhan, 2004).

Iran, due to its geographical location and geology, is among the ten most disaster-prone countries in the world, frequently experiencing floods, earthquakes, droughts, and storms that result in significant human and economic losses. Studies of over 40 natural hazards globally indicate that Iran is exposed to at least 31 recurring types of disasters, with no region completely immune. Approximately 86% of the country lies within earthquake-prone zones, highlighting the critical importance of risk reduction and mitigation, including the application of GENSAI-based product design to manage and reduce disaster impacts. There is great urgency for creating culturally appropriate design responses that meet the need of Iran's relatively high hazard exposure while utilizing the best practices from around the world in terms of disaster preparedness. Similarly, Japan is highly vulnerable to natural disasters, including severe earthquakes, volcanoes, and storms. Since the adoption of the Basic Disaster Management Law in 1962, Japan has developed a structured crisis management system operating at national, state, local, and municipal levels, ensuring continuous coordination among ministries and agencies (Montaseri, 2015). In addition, Japan has integrated the GENSAI approach into industrial design and product development to reduce disaster-related damages, providing a practical model for preparedness and mitigation. According to researchers, Japanese culture has developed its own distinct concept of bōsai, which includes the belief that preparation is not just an individual activity but rather an integral part of one's everyday life through community participation, design, and education (Kitagawa, 2019). This concept of embedding disaster preparedness into all aspects of daily life offers valuable insights for other nations experiencing the effects of disasters as they move from reactive practices to developing enduring, resilient infrastructures.

### *Definition of GENSAI Design*

This is one new concept word against natural disasters in Japan. After the great Hanshin-Awaji earthquake in 1995, a new idea came out from that experience of severe disaster. That is GENSAI instead of disaster prevention (Sagara & Shimoo, 2016). GENSAI has a meaning of 'disaster mitigation'. GENSAI is a new concept of preparedness for minimizing damage from natural disaster which we cannot escape. Violent natural disaster cannot be prevented completely, but there are many ways to keep the human damage to a minimum. By following this concept, it's not only enough to focus on the moment of emergency, but also the importance of effectively adopting measures into daily life.

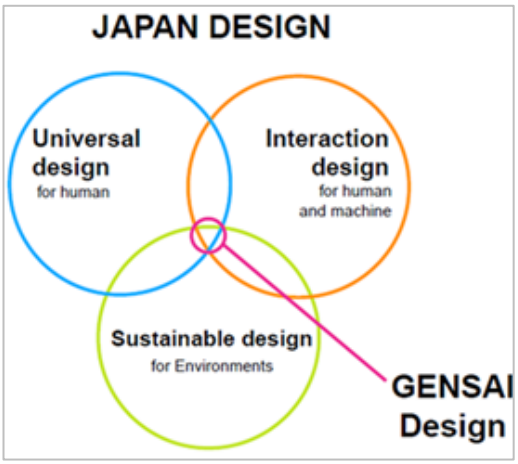


**Figure 2:** *Position of GENSAI Design within the broader landscape of contemporary Japanese design.*

GENSAI design reflects a paradigm shift in thought from "*preventing disasters*" (which means not allowing disasters to occur) to "*mitigating disasters*" (which accepts that we will experience disasters and focuses on reducing the negative effects of disasters). This philosophical change is consistent with modern concepts of resilience theory in design, which emphasizes "the need to design products, systems and services for both normal and disrupted conditions, maintaining their core functions when subjected to unexpected shocks" (Guo et al., 2023). With respect to the design of products, a GENSAI approach can turn common objects into life-saving tools by including emergency functions in the everyday items we use most frequently. This is one way to help address the significant difference between knowing you should be prepared for disasters and taking the steps to be prepared.

## *Specifications of GENSAI Ideas in Product Design*

Disasters often occur unexpectedly in daily life, requiring a shift in the product designer's paradigm from "*product-oriented*" to "*product-ready*" and from "*disaster-oriented*" to "*disaster-ready*." In the aftermath of a major disaster, accurate information about what has happened, when, and where is essential for making critical decisions, such as whether to evacuate or stay in place. Survival in challenging environments, such as dark, cold, or hazardous conditions, is the immediate priority. Once survival is ensured, individuals may assist those around them, followed by participation in recovery, reconstruction, and mitigation efforts. Ultimately, preparedness for future disasters becomes a continuous cycle. GENSAI-inspired product design aims to support users throughout this entire process, providing practical solutions at each stage (Figure 3).


**Figure 3:** *Disaster management cycle that outlines the stages of preparedness and response*

Disaster-Ready Design (DR) is an approach in which everyday products are designed and developed to function effectively during disasters. Disaster-Ready Products (DRPs) are intended for use not only in emergencies but also in daily life, ensuring they are practical and familiar to users while being useful in situations such as earthquakes, tsunamis, or other emergencies. The specific requirements and characteristics of DRPs for GENSAI Design products include:

**Dual-purpose use:** The product is not solely for emergencies; it is intended for everyday use or to be carried/worn regularly.

**Immediate readiness:** The product must be readily available and quickly deployable in case of disaster.

**User familiarity:** Users should be fully aware of the product's existence, functions, and performance, and it should be easy to use.

**Pre-designed disaster function:** The disaster-specific role of the product is intentionally designed by the designer, rather than improvised by the user (Figure 4).

The four characteristics listed above were used to evaluate the design proposals developed by students in the two design workshops. This evaluation framework aligns with the new concept of product resilience in the design and engineering literature, which is defined as "the ability of a product to endure, adapt to, and recover from disruptive events while maintaining necessary functions" (Guo et al., 2023). By utilizing these

four criteria in both the workshop briefing and design evaluation processes, this research ensured that the creativity of the design students was directed by well-established, theoretical principles and not by subjective opinions. The evaluation process was conducted by a small panel of specialists in industrial design, disaster preparedness and design education. Design concepts were rated independently on a five-point scale on innovation, feasibility, cultural adaptability, and fit with GENSAI principles. Proposal descriptions were anonymized during the evaluation process in order to reduce the potential influence of institutional or national affiliation on reviewer judgment. Any differences in scoring were discussed collectively to establish final consensus ratings.

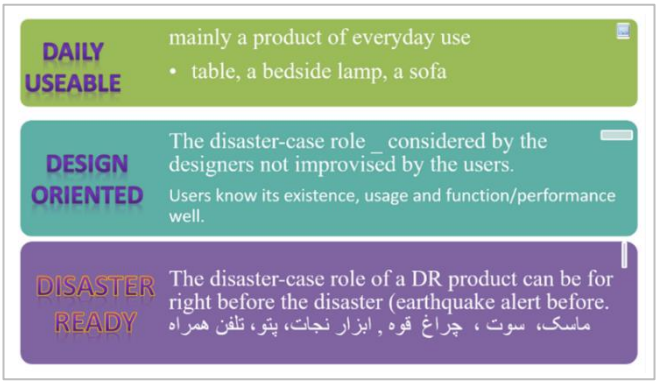


**Figure 4:** *Three properties required for DR approached products.* (Author)

Examples of products designed with the DR approach in the figures are numbers 5 and 6.


**Figure 5:** *Sample of DR Products, Mamoris,* (World Design Award, 2016).


**Figure 6:** *Sample of DR Products, Versa towel is usable, but in an emergency time easy to use as a bandage.*

It's known to everyone the importance of daily preparedness for surviving in an emergency, but for example, it might be difficult to gather emergency goods and prepare them in the house. So, to promote emergency preparedness, we face the challenge of "*How to prepare for what? And if we know the way to prepare, we have a further challenge of* "What to do to promote emergency preparedness? Surely, we can propose these challenges by way of design. GENSAI design fills this gap in the design and engineering process. By turning the abstract concept of preparedness into real-life, everyday products without added effort or extra storage requirements, it closes the gap between what we intend to do and what we actually do.

For context, the category distribution observed in the 2016 GDPC design competition is provided in Appendix B. These competition data are external to the present study's dataset and were not coded or analyzed; they are included only to situate the workshop concepts within the broader landscape of GENSAI-oriented design.

**Table 4:** *Comparative Analysis of Iranian and Japanese Design Concepts*

| Analytical Dimension | Iranian Workshop Findings | Japanese Workshop Findings | Comparative Interpretation |
|---|---|---|---|
| Dominant Category | Carrying and multifunctional concepts were the most frequently observed category among the analyzed Iranian workshop outputs. | Personal first-aid and hygiene concepts were the most frequently observed category among the analyzed Japanese workshop outputs. | The observed tendencies suggest that several Iranian concepts placed greater emphasis on carrying and multi-functional solutions, whereas a larger proportion of Japanese concepts focused on compact and individually oriented preparedness functions. These observations need to be interpreted with caution, as they are based on a small educational environment and may not reflect wider cultural patterns. |
| Innovation Level (Expert Panel Rating, 1-5) | Mean: 3.1 (SD: 0.8) | Mean: 3.8 (SD: 0.6) | The Japanese proposals showed more diversity and creativity in combining daily life and emergency functions, which may be related to the different levels of exposure to the GENSAI design discourse. |
| Cultural Adaptation Indicators | Integration of traditional Persian patterns and locally available textiles; designs referencing Iranian household spatial organization | Minimalist, compact designs optimized for limited urban living spaces; integration with existing Japanese emergency infrastructure (e.g., evacuation center protocols) | Both sets of proposals were deeply embedded in their respective cultural contexts, consistent with the GENSAI principle that preparedness must be culturally situated rather than universally prescribed. |
| Dual-Use Integration | Primarily additive (emergency features added to existing product types) | Primarily integrative (emergency and daily functions seamlessly merged into novel forms) | This difference may reflect differing prior exposure to GENSAI design within these specific educational settings; any claim of a broader developmental trajectory would require larger, controlled samples and is not warranted here. |

# Discussion of Comparative Findings

The comparative analysis demonstrates that each group of students interpreted and implemented GENSAI principles differently. While GENSAI design represented a relatively unfamiliar design approach for many Iranian participants within their educational context, they typically added emergency features to commonly recognized product types (i.e., bags and furniture). In contrast, several Japanese concepts in this workshop integrated emergency and everyday functions more seamlessly; given the small sample and the differences between the two workshop settings, this is offered as a context-dependent observation rather than as evidence of a stable cultural trait. This is in line with Nakano and Yamori's (2024) observation that good tools for disaster preparation need to be "culturally tuned" (including cultural values, spatial practices, and institutional environments).

The observed differences in innovation ratings should be viewed with caution, as they may be reflective of different levels of exposure to GENSAI design discourse as well as other contextual and educational factors identified in the study. Future studies conducted across a wider range of educational and cultural contexts

may help clarify whether the observed differences are associated with varying levels of exposure to GENSAI design principles or with other contextual factors. This interpretation corresponds to the findings of prior research on cross-cultural design education, which maintains that "design capability exists in all parts of the world but is exhibited in different manners according to the respective local design ecologies" (Kitagawa, 2019). These findings suggest that preparedness-oriented design is not transferred across cultures through direct replication of products but through reinterpretation of underlying principles. The results, therefore, support the need to adapt resilience-oriented design frameworks to the context and not to be universally standardized. This finding supports the importance of culturally grounded approaches in the design practice oriented to GENSAI.

### *Holding Workshops in Iran and Japan*

In recent years, natural hazards such as earthquakes and floods have caused significant and often irreversible damage in both Iran and Japan. Recognizing this shared vulnerability, the governments of both countries have incorporated public disaster-preparedness education into their national agendas. However, education alone cannot fully prevent or reduce post-disaster losses. The GENSAI design approach offers a complementary strategy by introducing practical, culturally informed products that support preparedness and crisis management. To familiarize future designers with this approach, GENSAI-focused workshops were held at Kobe Design University in Japan and the University of Tehran. Led by Dr. Farzam and Dr. Sagara, the workshops introduced the principles of GENSAI design before guiding students through the development of their own concepts. Following the instructional sessions, students generated creative ideas and product proposals, examples of which are shown in Figures 7 and 8. Details of the methodological specifications of the two workshops are found in the Research Methodology section in Table 1.


**Figure 7:** *Sample of design done by students participating in the workshop in Iran. The concepts shown are representative examples selected from a larger set of workshop outputs used during the analytical process.*

Several insights relevant to the research questions came out of the workshops. First, students in both contexts successfully learned the key GENSAI principle of dual-use design, producing concepts that work in both quotidian and emergencies. Second, cultural factors greatly affected design directions: Iranian proposals often addressed collective needs (e.g., family-sized emergency kits, community shelter accessories), while Japanese proposals in this workshop more often focused on individual and portable solutions; this is reported as a context-bound observation and is not generalized to national culture from the present sample. Third, the workshops demonstrated that a short, intensive introduction to the principles of GENSAI can produce feasible design concepts, suggesting that GENSAI design education can be effectively incorporated into current industrial design curricula.


**Figure 8:** *Sample of design done by students participating in the workshop in Japan. These examples are for illustrative purposes only and are not the complete data set used in the comparative analysis.*

These observations provide partial answers to RQ1 and RQ3. The similarity in students' understanding of the core principles suggests the potential transferability of GENSAI design across contexts, although further studies would be needed to confirm this. The dissimilarity of the design expression indicates the need for cultural adaptation. This finding directly informs the design framework proposed in the next section.

The results of these workshops indicate that GENSAI-inspired product design can meaningfully contribute to reducing and managing the impacts of natural disasters. When adapted to the cultural context of each community and further refined, these concepts have the potential to evolve into practical tools that enhance public resilience and disaster readiness.

# Results & Conclusions

The study highlights the ongoing need for practical and accessible emergency preparedness, especially in disaster-prone countries such as Iran and Japan. Analysis of the workshop-generated GENSAI concepts shows that preparedness can be addressed through a wide range of product categories, functional strategies, and culturally adapted design responses. Major categories identified through the coding process included first-aid, shelter, lighting, communication, furniture, carrying solutions, and other preparedness-oriented product types. Essential items like lighting, food, and water further emphasize basic survival requirements. Although GENSAI Design is still developing globally, its adoption in design schools reflects increasing interest and potential. This approach helps address two key challenges: understanding what to prepare for and finding effective ways to integrate preparedness into daily life. By offering user-centered, culturally responsive solutions, GENSAI Design can transform preparedness into practical products and services that strengthen community resilience.

Accordingly, the research questions guiding the current study are answered directly:

**RQ1:** *Similarities and Differences of GENSAI Design Concepts*: The comparative analysis showed that students in both Iran and Japan internalized the core GENSAI principles of dual-use functionality and immediate readiness. There were, however, notable differences in design expression within these two settings: Iranian concepts focused on collective-scale solutions (family kits, community items) and additive integration of emergency features into familiar product types. portable solutions with closer integration of daily and emergency functions. These differences are interpreted, tentatively, as reflecting differing institutional exposure to GENSAI design and context-specific preparedness orientations within the two settings studied; they are not offered as evidence of stable cross-cultural differences.

**RQ2***: Criteria for Assessing GENSAI Design Concepts*: The four criteria developed from the study, including dual-purpose use, immediate readiness, user familiarity, and pre-designed disaster function, were effective as an evaluative framework. The inclusion of innovation and cultural adaptability as dimensions of assessment was a more holistic tool for evaluation. The expert panel rating method (1–5 scales) provided a structured basis for comparing concepts and offers a potentially useful evaluation protocol for future GENSAI design studies. Given the exploratory nature of the present research, the evaluation findings should be interpreted as indicative rather than definitive.

**RQ3:** *A Preliminary GENSAI Design Framework*: Based on the comparison of findings and syntheses of the workshop results, a preliminary GENSAI Design Framework for Everyday Resilience is suggested. This framework, described in Figure 9, consists of three interrelated layers meant to serve as guidance for future developments of GENSAI products in various cultural settings.

The framework did not emerge from a single source of evidence. Rather, it was developed through an iterative synthesis of three complementary inputs: (1) the foundational principles of GENSAI and disaster-ready design identified in the literature, (2) patterns observed in the workshop-generated concepts from both countries, and (3) reflections arising from the comparative evaluation process. The framework should therefore be regarded as a preliminary interpretive model intended to organize and communicate emerging design principles rather than as a finalized or fully validated theory.

**Table 5:** *Derivation of Each Framework Component from the Evidence Base*

| Framework Component (Layer) | Primary Evidence Source | Specific Observation | Translation into the Framework |
|---|---|---|---|
| Dual Functionality (Layer 1) | GENSAI / DR literature + both workshops | *Literature defines GENSAI as embedding emergency function in everyday objects; most analyzed concepts in both sites paired a daily and an emergency function* | Adopted as the foundational principle |
| Immediate Readiness (Layer 1) | Both workshops + expert panel | *Concepts rated highly on feasibility consistently emphasized instant access and deployment; experts flagged accessibility as decisive* | Abstracted into the readiness principle |
| User Familiarity (Layer 1) | Workshop observation | *Concepts built on familiar product types (bags, towels, household items) were judged easier to adopt without training* | Generalized into the familiarity principle |
| Intentional Design (Layer 1) | Expert evaluation | *Experts valued concepts whose emergency role was pre-engineered by the designer over those relying on user improvisation* | Formalized as the intentionality principle |
| Miniaturization & Integration (Layer 2) | Japanese workshop pattern | *The more integrative Japanese concepts merged emergency and daily functions into single compact forms, reducing the storage burden* | Translated into the integration strategy |
| Modularity & Customization (Layer 2) | Iranian workshop pattern + comparative contrast | *Iranian concepts scaled to household and community sizes and varied hazard types through additive, modular features* | Translated into the modularity strategy |
| Cultural Grounding (Layer 2) | Cross-cultural comparison + expert ratings | *Concepts referencing local materials and forms (Persian textiles; Japanese compact-living norms) scored higher on cultural adaptability* | Abstracted into the grounding strategy |
| Collective & Individual Scaling (Layer 2) | Comparative synthesis | *Iranian concepts are skewed collective, and Japanese concepts are individual; the framework must span both* | Synthesized into the scaling strategy |

To illustrate the derivation concretely, Cultural Grounding (Strategy 3) was reached as follows: across both sites, concepts that referenced locally situated materials or forms — Persian textiles and household spatial organization in Iran, compact-living optimization in Japan — received the highest expert ratings on cultural adaptability. This recurring observation, read against the GENSAI literature's insistence that preparedness be situated rather than universally prescribed, was abstracted from a concept-level pattern into a framework-level strategy. Each remaining component in Table 5 was derived through the same move: from a recurring, expert-corroborated observation to an abstracted design directive.

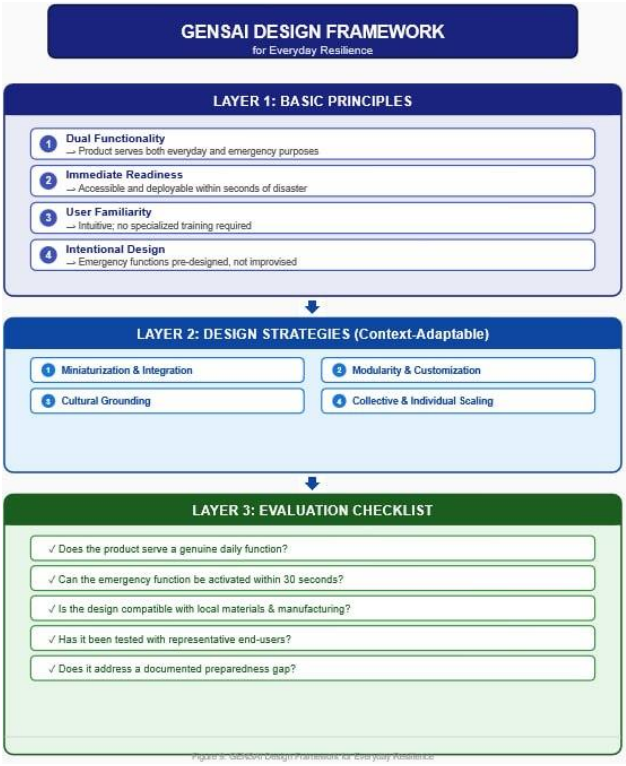


**Figure 9:** *GENSAI Design Framework for Everyday Resilience*

**Layer 1:** *Basic Principles*

- Principle 1: Dual Functionality — The product must serve both every day and emergency purposes.
- Principle 2: Immediate Readiness — The product must be accessible and deployable within seconds of a disaster.
- Principle 3: User Familiarity — The product must be intuitive, requiring no specialized training for emergency use.
- Principle 4: Intentional Design — Emergency functions must be pre-designed by the designer, not improvised by the user.

**Layer 2:** *Design Strategies (Context-Adaptable)*

- Strategy 1: Miniaturization and Integration — Embed emergency functions within existing everyday objects to eliminate storage burdens.
- Strategy 2: Modularity and Customization — Design for adaptability to different household sizes, hazard types, and cultural preferences.
- Strategy 3: Cultural Grounding — Incorporate local materials, aesthetic traditions, and social practices to ensure adoption and sustained use.
- Strategy 4: Collective and Individual Scaling — Offer solutions that address both personal preparedness and community-level needs.

**Layer 3:** *Evaluation Checklist*

- Does the product serve a genuine daily function that ensures its regular use and accessibility?
- Can a user access and activate the emergency function within 30 seconds without prior instruction?
- Is the design compatible with locally available materials and manufacturing capabilities?
- Has the design been tested or reviewed with representative end-users from the target community?
- Does the product address a documented gap in existing preparedness resources for the specific hazard context?

To illustrate the practical application of the framework we will consider a shoulder bag for daily use with built-in emergency features. The bag is good for fundamental principles, for daily needs and for emergencies. At the strategic level, emergency features such as first-aid supplies, signaling elements, or temporary shelter components are integrated into the product without compromising daily usability. Finally, the evaluation checklist may be used to assess accessibility, usability, cultural appropriateness, and preparedness value. This example demonstrates how the framework may guide both the development and evaluation of future GENSAI products.

This framework constitutes the main contribution to knowledge that this paper makes. Firstly, it contributes to the discourse on GENSAI design by extending it in terms of (a) synthesis of basic principles of design that have been defined in the course of Japanese practice and a comparative cross-cultural study, (b) providing actionable tips to designers from different cultural backgrounds, and (c) giving evaluative guidelines for evaluating GENSAI design quality. This framework is only preliminary and needs further verification through practical designs and field testing.

## Implications and Future Research:

The results of the study imply a variety of implications for design education, disaster policy, and product development. In terms of design education, the study suggests that GENSAI principles may be successfully applied in intensive workshops; thus, the topic of disaster-preparedness design may be included in industrial design curricula worldwide. From a policy perspective, the study implies that product design should be recognized as an important element of any country's disaster risk reduction strategy. This element seems to be underappreciated in most countries except Japan. Finally, the developed framework will help designers and manufacturers to start exploring this market.

It must be noted that there are certain drawbacks to the conducted study. First, the study involved only a limited number of participants – students-designers of two universities. Second, the evaluation was conducted by academic specialists rather than practitioners directly involved in disaster-response operations. Third, the designs developed were purely conceptual. In addition, the two workshops differed in participant composition, recruitment procedures, duration, output media, and prior exposure to GENSAI and bōsai concepts. Consequently, observed differences between the two groups should be interpreted as exploratory and context-dependent rather than as evidence of purely cultural effects.

Moreover, the comparative analysis of the results was conducted after conducting experiments rather than as an element of the experimental design from the very beginning. Furthermore, the study was performed in educational workshop settings and was mainly based on conceptual design outputs, which should be interpreted as evidence of the exploratory potential of the GENSAI-oriented design, rather than the real-life efficacy of specific products. The proposed framework was informed by empirical observations and expert review, but its practical applicability remains tentative until further tested through prototyping, user-centered evaluation, and implementation in real preparedness contexts. Further research should focus on eliminating the above-mentioned drawbacks of the research through: (a) wider-scale empirical research with participation of professional designers and users of the products created; (b) longitudinal testing of the effectiveness of the products in emergencies; and (c) development of experimental designs aimed at varying cultural and instructional variables and assessing their impact on the product.

Ultimately, the findings show that design plays an important role in disaster risk reduction and in building a more prepared and resilient society. The GENSAI Design Framework for Everyday Resilience may serve as a first step toward designing a wide range of emergency-related products, with the help of which the general idea of "being ready" for disasters may become more tangible and even desirable to people.

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