Gaming a Crisis: Insights From a Bibliometric Literature Review

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ABSTRACT

As crises become more prominent, serious gaming is emerging as an innovative tool to practice crisis management, yet a comprehensive overview of its applications remains lacking. Subsequently, this article poses the following research questions: What are the current applications of serious gaming in the field of crisis management? What are the emerging trends regarding the use of serious gaming in crisis management? Through a bibliometric review in combination with bibliographic coupling, we identified four themes: (1) healthcare, (2) disaster risk reduction and climate change, (3) adolescents and students, and (4) wargaming. Furthermore, our analysis reveals three critical trends: (1) diverse applications but inconsistent methodological rigor, (2) a divide between studying games as research objects (e.g., evaluating effectiveness) and using them as research tools (e.g., testing behaviors), and (3) a fragmented literature, hindering unified theoretical or practical frameworks.

Keywords

Serious Game, Tabletop, Wargame, Crisis Management, Disaster Management.

INTRODUCTION

In recent years, our society has been exposed to a plethora of high-impact crises including public health disruptions, geopolitical tensions, and climate-related disasters. As these crises tend to become increasingly prominent, interrelated, and transboundary, alternative crisis management practices to advance skills and response tactics are actively being explored. Subsequently, practices such as serious gaming (Gates, 2022; Solinska-Nowak et al., 2018) and wargaming (Linden, 2021; Nieuwborg et al., 2025) have gained much traction.

Serious games and wargames, as respectively defined by Salen and Zimmerman (2004) and Perla (2022), serve as structured models or systems that simulate artificial conflicts governed by rules, yielding quantifiable outcomes (e.g., a win or a loss). What makes these practices particularly relevant for crisis management is their ability to embed decision-makers in immersive narrative experiences. While fully immersed in a fictional crisis, participants need to make acute, high-impact decisions, observe their effects, and respond to other actors, thereby fostering the creation of so-called "memories of the future" (Schwarz, 2009). As these games can be conducted indefinitely and in a safe learning environment, participants' decision-making capabilities in times of crisis are expected to improve (Caffrey, 2019). For the sake of simplicity, this article will, from this point forward, use the term serious games. Other practices, such as the aforementioned wargames, or tabletops are considered synonyms.

Despite the growing popularity of serious gaming as a tool for crisis response, surprisingly, a general overview of its application within the broader crisis management domain remains lacking. While existing literature reviews have explored specific niches, such as Solinska-Nowak et al.'s (2018) analysis of 45 non-commercial serious games in disaster risk management, Skryabina et al.'s (2017) examination of emergency exercises in healthcare, and Kankanamge et al.'s (2020) focus on gamification in disaster-related activities, no reviews exist that map the overall relationship between serious gaming and the diverse settings of crisis management. Subsequently, to address this research gap, we propose the following research questions: What are the current applications of serious gaming in the field of crisis management? What are the emerging trends regarding the use of serious gaming in crisis management? To answer these questions, we employ a bibliometric review, enabling us to systematically analyze the scholarly landscape and present our first findings in this Work in Progress paper.

METHOD

This article conducts a bibliometric review methodology based on the work of Donthu et al. (2021) with the primary goal of providing an overview of serious gaming and crisis management. Their procedure consists of four steps: (1) define the aim and scope of the bibliometric study, (2) choose the techniques for bibliometric analysis, (3) collect the data for bibliometric analysis, and (4) run the bibliometric analysis and report the findings.

In the first step, we determined the research questions: What are the current applications of serious gaming in the field of crisis management? What are the emerging trends regarding the use of serious gaming in crisis management? Our initial scans of the literature on Web of Science using the search terms of 'crisis' and 'serious game' revealed many results across different outlets. We identified 344 articles, justifying the use of a bibliometric review in order to map this landscape (Donthu et al., 2021).

As a second step, we sought to provide an overview of the current use of serious gaming in crisis management. For providing such an overview, Donthu et al. (2021) suggest that bibliographic coupling is recommended for analyzing current trends. Bibliographic coupling is a technique for science mapping that assumes that two publications sharing common references are similar in content (Kessler, 1963). This allowed us to identify patterns in the literature landscape and look for congruence between sets of studies.

Once the markers for our review were set, we engaged in the third step to retrieve the actual data or records for the bibliometric review. For this study, records were collected from the Web of Science database as it provided a broad enough overview of the literature across different fields of study. The following search string was utilized in the topic section: "serious gam* AND (cris*s OR disaster*) or tabletop* AND (cris*s OR disaster*) or wargam* AND (cris*s OR disaster*) or "war game" AND (cris*s OR disaster*)". For this study, we utilised terms as "tabletop*", "wargam*" and "war game" to broaden our scope and not exclude studies that used a different spelling. In practice, we noted that these terms are often used interchangeably with the term serious gaming. Furthermore, only English articles and proceedings were included, reviews were excluded. The data was collected on the 16th of February 2025 and yielded 473 results and 1 duplicate. The final total thus consists of 472 articles and proceedings.

As the fourth and final step, we conducted a visual bibliometric analysis by making use of the programme VOSviewer, a software tool for constructing and visualizing bibliometric networks (Van Eck & Waltman, 2010). This software enabled us to observe patterns in the literature, such as suggested clusters based on co-word occurrence and co-authorship. The visual output of VOSviewer served as a boundary object for the involved researchers to discuss, question, and pin down important trends in the literature. To enable this process, we conducted bibliographic coupling by using individual publications as the unit of analysis, combined with fractional counting. By back-and-forth testing and parameter tweaking, we found that 9 citations were the minimum needed to organize the clusters into a clear overview we could make sense of and ground in the underlying literature. Afterwards, all findings were drafted into a report, reviewed, and presented in this study.

RESULTS

The bibliographic coupling analysis identified 13 clusters, many of which exhibited significant thematic overlap. Subsequently, these clusters were consolidated into four overarching themes. The four overarching themes pertain to (1) healthcare, (2) disaster risk reduction (DRR) and climate change, (3) adolescents and students, and (4) wargaming. The following sections will elaborate on the literature encompassing each theme. Figure 1 provides a network visualization capturing the clusters and the overarching themes. Figure 2 provides an overlay visualization, indicating the year of each publication. The following subsections provide an overview of each theme and illustrate it with several prominent articles.

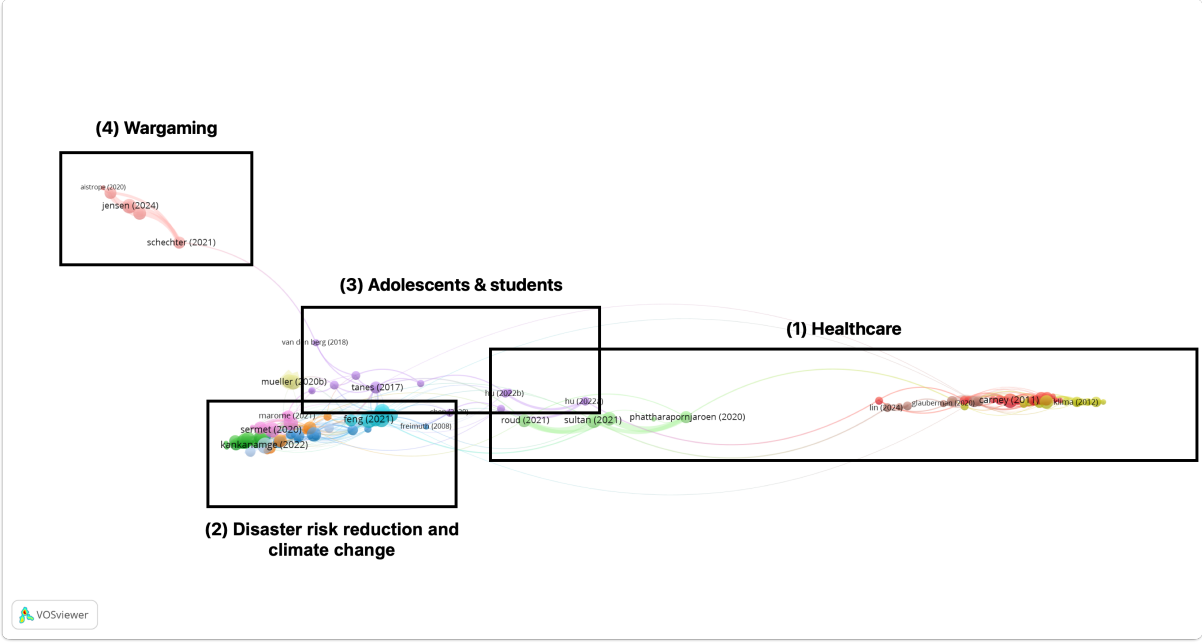

Figure 1 Bibliographic coupling network visualization with the four overarching themes highlighted.

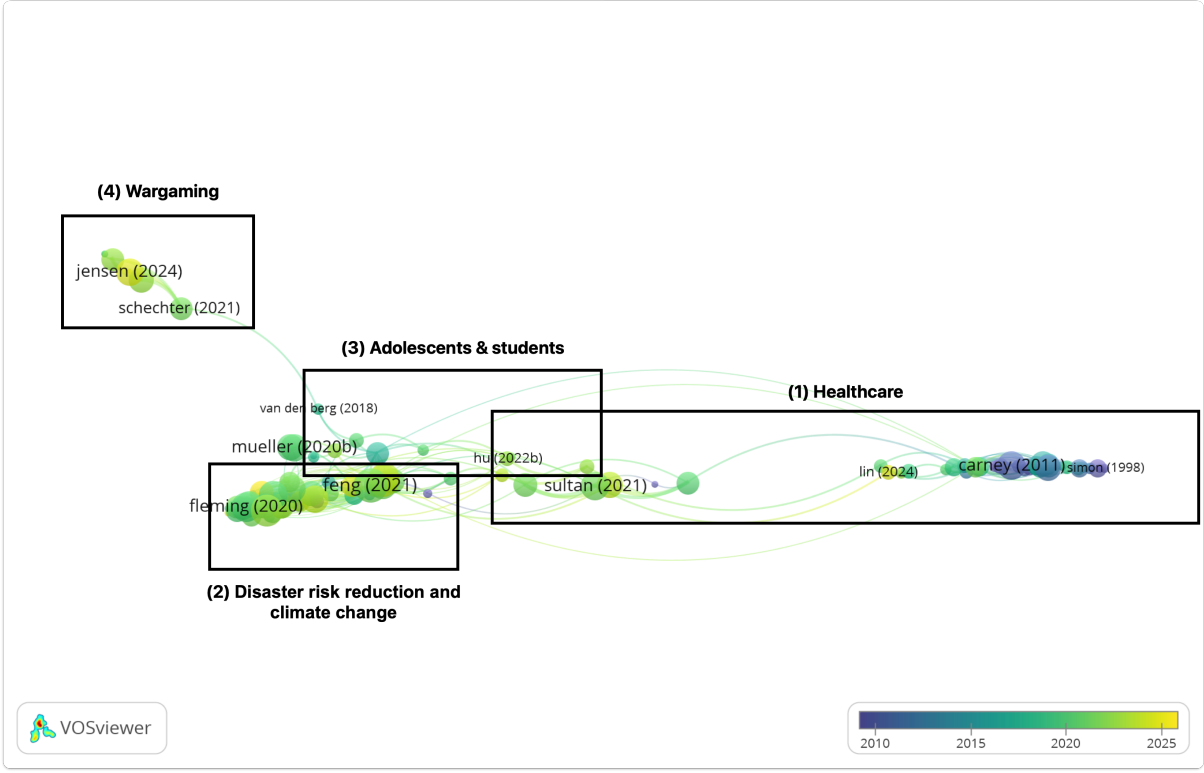

Figure 2 Overlay visualization that classifies the development of themes over time.

Healthcare

The first theme, and arguably the largest and oldest (i.e., around 2010-2015), concerns the use of serious games in healthcare-related crises. This theme consists of five subthemes: (1) the training of healthcare professionals, (2) Chemical-Biological-Radiological-Nuclear incidents (CBRN), (3) infectious diseases, (4) mass casualty events, and (5) disaster preparedness in hospitals.

First, serious gaming is widely used to train healthcare professionals. For instance, Ngo et al. (2016) and Uddin et al. (2008) demonstrated the value of tabletop exercises in disaster medicine and emergency preparedness curricula, respectively. Ngo et al. (2016) report that integrating tabletop scenarios within a disaster medicine curriculum improved learners' disaster knowledge and confidence in managing mass-casualty events, supporting the feasibility of embedding such exercises in routine residency training. Similarly, Uddin et al. (2008) demonstrate that tabletop exercises contributed to a multifaceted approach to learning in a tightly scheduled medicine residents' curriculum, allowing students to develop competencies in synthesizing and applying knowledge, thereby producing high-quality products such as disaster plans and after-action reports. In nursing education, Evans et al. (2019) found that students successfully demonstrated medical-surgical knowledge through a tabletop exercise. Participation in the tabletop exercise led to statistically significant improvements in students' ability to correctly assess patient acuity and engage in physical and functional assessment. However, it also indicated a lower transfer of basic medical-surgical knowledge, suggesting that tabletop exercises were better at inducing higher-order learning objectives. Glauberman et al. (2020) also developed a tabletop exercise that improved interprofessional collaboration and disaster management skills among nursing students. Lin et al. (2024) further demonstrated that a two-day training program, combining simulations, tabletop exercises, and transdisciplinary strategies, significantly enhanced nurses' readiness for disaster response. Across all these studies, we thus witness evidence of increased learning efforts in higher-order learning objectives, such as synthesizing and applying knowledge.

A second subtheme focuses on serious gaming for CBRN (Chemical, Biological, Radiological, and Nuclear) risk preparedness. Malizia (2016) details a tabletop exercise involving Italian and international agencies, simulating a CBRN scenario to test the effectiveness of their master classes and to verify the quality of emergency planning preparation. The study reports that participants showed gains in risk assessment, detection, and monitoring, and were able to organize rescue and casualty management according to the field's standards. The tabletop exercise effectively strengthened multi-agency readiness for complex CBRN events. Similarly, High et al. (2010) evaluated a community-wide tabletop exercise in the southeastern U.S., demonstrating its effectiveness in fostering interagency and public-private collaboration during chemical disaster preparedness. Their findings showed increased stakeholder awareness of capability gaps and enhanced communication pathways between public and private sector agencies.

The third subtheme explores the use of serious gaming for infectious disease preparedness. Sarpy et al. (2005) developed a tabletop exercise simulating a severe acute respiratory syndrome event for 49 public health workers and partners in Arkansas, demonstrating improved competency-related knowledge and skills. Lurie et al. (2008) conducted tabletop exercises within the U.S. Department of Veterans Affairs, revealing gaps in communication and coordination and emphasizing the need for joint planning to enhance pandemic preparedness. Finally, Rega & Fink (2014) implemented a semester-long immersive simulation for graduate public health students, consisting of tabletop exercises, which students found educational and effective in understanding pandemic management complexities.

The fourth subtheme focuses on serious gaming for mass casualty events. Hirshberg et al. (2001) proposed using discrete event computer simulations and war game tabletop exercises to train personnel in triage. Furthermore, McElroy et al. (2019) and Leow et al. (2012) conducted tabletop exercises on mass casualty events as part of a larger training program in a regional trauma organization and a collaboration between an international non-governmental organization and the Sierra Leone Office of National Security, respectively. These findings underscore the potential of combined simulation and tabletop approaches to enhance preparedness by exposing clinicians to realistic surge dynamics and decision-making demands.

Finally, the fifth subtheme addresses serious gaming for hospital disaster preparedness. Djalali et al. (2012) demonstrated poor preparedness and performance in 23 Iranian hospitals through tabletop exercises. Their evaluation revealed substantial deficiencies in planning, decision-making, and use of command structures within the Hospital Incident Command System (HICS), indicating that many facilities were insufficiently prepared to manage complex disaster scenarios. Klima et al. (2012), when studying a 16-hospital full-scale exercise, are critical of the use of tabletop exercises. They emphasize that full-scale operational drills expose latent system vulnerabilities, such as communication failures, resource allocation challenges, and breakdowns in interdepartmental coordination, that tabletop formats tend to obscure. While tabletop exercises offer value for conceptual readiness, only full-scale exercises reliably uncover operational weaknesses.

Disaster risk reduction and climate change

The second largest theme addresses serious gaming in the context of DRR and climate change. Three subthemes have been identified: (1) DRR, (2) earthquakes, and (3) floodings.

The first subtheme explores serious gaming for DRR in general. Abad et al. (2020) and Fleming et al. (2020) utilize RAMSETE, a tabletop, role-playing, and scenario-based exercise designed to elicit stakeholder information on policy issues related to DRR and climate change adaptation. Participants considered RAMSETE as a useful tool for framing discussions about complex issues. Their empirical findings show that the exercise facilitated richer articulation of stakeholder preferences between climate change adaptation and DRR communities. It enabled participants to identify trade-offs between competing policy objectives and stimulated more nuanced reflection on climate change adaptation versus DRR strategies. The game enhanced cross-stakeholder dialogue, helping reveal divergences in priorities and areas of potential consensus, thereby demonstrating its value as a structured information-elicitation method in multi-actor decision contexts.

Kankanamge et al. (2020) utilized a gamification exercise in combination with social media analytics to understand public perceptions towards online education practices for disaster preparedness and the effectiveness of gamification. Results showed higher satisfaction and engagement with gamified tools, while also highlighting the promise of virtual and augmented reality. Delima et al. (2021) investigate how serious games facilitate the co-creation of DRR-related knowledge. They found that crises experienced during the game, real-life-based arguments utilized by the players, and players' interpretations are key factors in the co-creation process.

A second subtheme focuses on serious gaming for earthquake preparedness. Feng et al. (2021) developed a virtual reality serious game for earthquake training targeting children. The game demonstrated, through post-game assessments, that children's knowledge acquisition and self-efficacy improved compared to traditional methods utilizing leaflets. Mossoux et al. (2016) introduced Hazagora, a board game designed to educate students, citizens, and risk managers about geohazards and DRR strategies. The game appeared to be an effective tool to positively enhance the players' insights into processes involved in disasters.

The third subtheme explores serious gaming for flood preparedness. Gordon & Yiannakoulias (2020) used serious games to understand the factors that influence risk mitigation decisions. They found that in-game flood experiences strongly influenced mitigation decisions, more than real-life exposure, while revealing income barriers to risk reduction. D'Amico et al. (2023) developed a virtual reality serious game within the context of flood safety training. Participants demonstrated a significant increase in self-efficacy and safety knowledge after playing the game. The game effectively improved participants' understanding of flood evacuation procedures and increased their ability to recognize unsafe conditions. This indicates that even low-cost, non-immersive VR formats can meaningfully support flood preparedness and safety training. Furthermore, the study indicates similarities between real-world behaviors and VR choices (e.g., in the effects of signage) based on the collection of experimental data on behavioral issues, thus suggesting its value to support the development and validation of flood evacuation simulators. Gamberini et al. (2021) researched on the design of virtual environments for serious games to convey appropriate social and psychological "cues" to players. Their findings show that carefully designed visual and environmental elements may enhance users' situational awareness and perceived threat realism. The study demonstrated that the adopted method generated suitable virtual scenarios that may assist in improving the well-being of citizens exposed to flood risks.

Adolescents and students

The third theme is a significantly smaller, less dense, and less coherent cluster, yet it remains distinct. It addresses serious games specifically designed for adolescents and students interested in safety and crisis management. Abraham et al. (2020) developed a serious game prototype to educate teens about prescription opioid safety and provide an overarching framework. Preliminary results showed the game was engaging and realistic, though improvements in clarity, instructions, and technical stability were needed. Tanes (2017) examined the effects of repetitive play of an earthquake preparedness game. Their study suggests that serious games should encourage repetition, while allowing players to progressively gain content self-efficacy. It is interesting that, in these instances, serious games are not used to train professionals but to engage and raise awareness among a population prone to specific hazards. Such preparedness can also become an important function of serious gaming.

Wargaming

The final theme forms a distinctly separate and newer stream of literature (i.e., 2020s and onwards) and focuses on the use of wargaming. We expect this topic to gain traction in the coming years, given the wars and conflicts in a rapidly changing, renewed geopolitical landscape. Current studies of wargaming engage with various aspects, such as decision-making, risk management, and escalation dynamics.

Schechter et al. (2021) discuss integrating wargaming with social scientific methods to answer broader questions about decision-making. Their study shows that experimentally structured wargames can yield systematic, reproducible data on how actors interpret information, assess risks, and choose between escalation and de-escalation measures. This methodological integration enhances the ability to observe causal mechanisms in decision processes, making wargaming a more robust tool for theory development and hypothesis testing, and is also relevant to crisis research.

Schneider et al. (2022) examine the role of cyberspace operations through a two-year crisis wargame series. They conclude that while cyber tools are increasingly used, participants tend to employ cyber capabilities to shape narratives as a complement to diplomatic efforts but rarely view them as credible instruments for decisive coercion. The authors further demonstrate that cyber actions produced minimal shifts in strategic posture during simulated crises, reinforcing the idea that cyberspace operations function mainly as auxiliary tools within broader statecraft rather than as independent escalatory triggers.

Utilizing experimental wargames, Jensen et al. (2024) further investigate how cyber response options reduce escalation risks as they provide non-escalation alternatives. Their results demonstrate that when actors are offered calibrated cyber response tools, they systematically choose these over kinetic or escalation options. The authors show that in such wargames, cyber operations lower perceptions of aggression and significantly dampen incentives for escalation during interstate confrontations. Finally, Lin-Greenberg (2022) explores how drones affect escalation dynamics using a comparison between wargames. The article reveals that the use of drones may limit escalation compared to manned aircraft. Experimental evidence shows that participants were less likely to retaliate forcefully after unmanned losses, viewing them as less politically and emotionally costly. As such, these wargames provide an important testing ground to study how decision-makers perceive and consequently navigate escalation dynamics in volatile geopolitical settings.

DISCUSSION

This article investigates the following research questions: What are the current applications of serious gaming in the field of crisis management? What are the emerging trends regarding the use of serious gaming in crisis management? Based on preliminary findings of our bibliometric review, we identify four dominant themes emerging in the literature: (1) healthcare, (2) DRR and climate change, (3) adolescents and students, and (4) wargaming. In general, we seem to observe a shift in focus from healthcare-related serious gaming around 2010-2015 towards DRR and climate change and wargaming in the 2020s and beyond. Serious games seem to follow the trend of prominent crises and disasters worldwide, as we often see in this field (Wolbers et al., 2021). Furthermore, reflecting on the captured literature, we identify three trends which could serve as a basis for future research: (1) methodological diversity and ambiguity, (2) researching games and research through gaming, and (3) fragmented literature. The following paragraphs will elaborate on each trend.

First and foremost, we notice a wide diversity, and often ambiguity, in what is considered a serious game. This diversity and ambiguity seem to coincide with our four themes. We notice that articles encapsulated in the healthcare cluster frequently refer to the use of tabletops but rarely elaborate on what such tabletops entail (e.g., Lin et al. (2024), McElroy et al. (2019)). Subsequently, it is difficult to judge to what extent such tabletops are actually serious games, allowing players the freedom to explore a set of moves, or rather pre-scripted simulations. Articles in the DRR and climate change, and wargaming clusters seem to be more rigorous in their methodology, thus showcasing the breadth of serious game designs. For example, Abad et al. (2020) and Fleming et al. (2020) provide an in-depth overview of the serious game series called RAMSETE. The game aims to assess policy preferences regarding DRR and climate change adaptation while utilizing game mechanics such as resource and deck management. Teague et al. (2021) employ a unique approach by developing a serious game for water resources planning and hazard mitigation, fused with a tournament aspect. Nieuwborg et al. (2024, 2025) introduce a seminar-style wargame for operationalizing organizational resilience. Reflecting on these findings, we advocate for greater methodological rigor in serious game design. Furthermore, we see a research opportunity in mapping and reviewing different serious game approaches, measuring participants' behavior or traits, and assessing their value in the context of different crises.

Second, we notice a discrepancy in how games are used: either studies examine the effectiveness of games, or research is conducted through gaming. The former is the most prevalent and focuses predominantly on the effectiveness of games in transferring certain learnings. For example, Rega & Fink (2014) use tabletop exercises to teach students about the complexities of pandemic management, and Mossoux et al. (2016) use a board game to educate students, citizens, and risk managers about geohazards and DRR strategies. The latter, research through gaming, seems to only emerge in the context of wargames. Such games are used as tools to study decision-making in times of crisis and to gain an understanding of likely outcomes. For example, both Lin-Greenberg (2022) and Schneider et al. (2022) explore, through wargames, how cyber or drone usage might escalate or de-escalate a

certain conflict. Further investigation into the functions games may have across different fields can create opportunities for cross-sectoral learning about a variety of use cases.

Third, we notice a significant fragmentation in the overall body of literature (see Figure 1). Although several domains (e.g., healthcare or DRR) use serious gaming in the context of crisis, there is little overlap or a shared approach across domains. Studies tend to evolve within their own disciplinary silos: healthcare simulations focusing primarily on hospital preparedness and mass-casualty response (e.g. Djalali et al., 2012), DRR research emphasizing community resilience and hazard awareness (e.g., Abad et al., 2020; Fleming et al., 2020), and defense-oriented work centering on wargaming and strategic decision-making (e.g., Schechter et al., 2021; Schneider et al., 2022; Jensen et al., 2024). As a result, methodological standards, evaluation metrics, and underlying learning objectives vary substantially, limiting cumulative knowledge development on the use and added value of different serious game designs. Only a few studies explicitly connect insights across sectors or explore how simulation design principles might transfer from one crisis domain to another (Mayer et al., 2014; Meulemeester & Nieuwborg, 2025). This lack of cross-fertilization suggests that serious gaming remains a patchwork of parallel efforts rather than a coherent, integrated research field. Additionally, we seem to observe a shift in the literature from healthcare to DRR and climate change, and towards wargaming. Further investigating this shift and exploring a common framework regarding serious gaming in crisis could be a promising avenue for future research.

Overall, based on the insights from our literature review, we regard several priorities for future work. As the literature on this topic is quite fragmented, we see the need to develop of a unified, cross-sector conceptual framework that specifies what constitutes a serious game in the field of crisis and disaster studies. Such a framework could map core design elements, such as role structure, uncertainty, resource constraints, and feedback mechanisms, which allow for specifying key learning and research objectives. Advancing such a framework should go hand in hand with common evaluation standards that move beyond ad-hoc, post-exercise self-reports toward validated instruments capable of comparing outcomes across games and settings and over time. This would also facilitate systematic inquiries into the transferability of design principles between domains.

Methodologically, promising opportunities in the era of Artificial Intelligence and Large Language Models lie in coupling games to dynamic models and data streams (e.g., agent-based models, digital twins, or real-time sensing) so that player decisions interact with evolving system states rather than static scenarios, thereby increasing ecological validity and enabling richer process tracing. Expanding the use of serious games as living laboratories could be a promising research objective. Especially, since crises are often regarded as unique events, little cross-case comparisons or learning lines exist (Wolbers et al., 2021). Rather than treating games solely as training interventions, researchers can leverage them to study crisis behavior such as sensemaking, coordination, leadership, and information flows under controlled yet realistic conditions. Across all these directions, ethical and equity considerations warrant explicit attention, including how scenarios represent vulnerable populations, how potential harms (e.g., (re)traumatization or biased risk portrayals) are mitigated, and how inclusion is ensured in design and facilitation.

Finally, longitudinal and comparative designs are needed to track retention, transfer key insights to practice, and compare with performance under real incidents. Benchmarking serious games against alternative modalities such as full-scale drills or VR training would allow the field to accumulate evidence about when, how, and for whom different game designs add the most value. Serious games hold much promise for this domain, but more attention is needed to foster cumulative progression across subdomains and to realize this potential for the broader field of crisis and disaster management.

CONCLUSION

In this study, we investigated: What are the current applications of serious gaming in the field of crisis management? What are the emerging trends regarding the use of serious gaming in crisis management? After conducting a bibliometric review in combination with bibliographic coupling, we identified four prominent themes in the literature: (1) healthcare, (2) DRR and climate change, (3) adolescents and students, and (4) wargaming. Our review also highlighted several key trends. First, while serious games are applied across a diverse range of contexts, their methodological rigor varies significantly. Second, research in this field tends to either study games as objects of analysis, examine their effectiveness, or conduct research through gaming to test hypotheses or behaviors in controlled environments. Finally, the literature on serious gaming in crisis management remains fragmented, which poses challenges for developing unified theories or best practices.

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