Commentary

A Serious Role-Playing Game as a Pedagogical Innovation to Strengthen Flood Resilience

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Flooding is a global concern with an increasing number of floods and damages because of a changing climate. This has prompted the development of innovative approaches to flood resilience, both in terms of the technical aspects of flood risk management (FRM) and broader social initiatives to improve flood risk governance (decision-making and collaborations) among stakeholders. FRM encompasses policies and practices developed to prevent, manage, and reduce the impact of disasters across the disaster phases: preparedness, response, recovery, and mitigation. In this commentary, we discuss how game-based learning on flooding can be used with students and stakeholders as a pedagogical innovation to learn about the complexity of flooding and enhance flood resilience—the capacity to resist, absorb, and recover from floods and to transform and adapt to future flood risks [1], [2].

Flooding is Canada's most costly and frequent disaster. Historically, the dominant strategy for addressing flooding in Canada has been by "fighting water" with physical "hard" infrastructure such as dams and dikes, which emphasize engineering and technical solutions, in contrast to a "living with water" approach or more sustainable and socially equitable solutions [3]. Scholars critique physical infrastructure approaches as ineffective because flooding routinely exceeds defense structures and disaster assistance and removes the incentive for property owners to reduce their risk [4]. Governance scholars also critique the emphasis on infrastructure approaches because spending scarce public resources on structural defenses to permit development on flood-prone lands raises questions about fairness and equity [5]. At the same time, few Canadians know their flood risk, highlighting poor transparency and accountability.

In addition to Canada's reliance on infrastructure solutions, another challenge is that decision-making processes in Canada often fail to provide sufficient interaction among stakeholders to understand different viewpoints or value tensions [6]. However, difficult conversations are needed because the causes and consequences of flooding are embedded in complex sociopolitical contexts involving diverse stakeholders with conflicting interests and power imbalances. The flooding problem is also difficult to solve because it is a wicked problem, meaning it is ill-defined, complex, and not amenable to a definitive solution [7]. Traditional engineering education relies on well-defined and structured problems and does not adequately prepare students for understanding the complex social dimensions [8].

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Therefore, in Canada, enhancing flood resilience requires "a change in the culture and the institutional arrangements for flood risk management at all levels" [9, p. 117]. Consequently, a combination of social innovation and responsible innovation is needed to advance flood resilience [9]. Social innovation is a "novel solution to a societal problem that is more effective, efficient, sustainable, or just...," whereas responsible innovation adds "transparency, interaction, ethics, acceptability, sustainability, and social desirability" [10, pp. 2–3].

FRC game as a pedagogical innovation

The flood resilience challenge (FRC) game is a pedagogical innovation that incorporates both social and responsible innovation in the form of a serious role-playing game developed and implemented by the FRC team (including the authors). Serious games are a well-established technique for exploring natural resource management issues, including wicked problems and policy development [11]. More specifically, role-playing games that operate as serious games have been used as tools for experiential learning that seeks to engage and educate players, rather than just entertain them, about wicked problems in a simulated environment [12].

As an educational and engagement tool, the FRC game aims to build the capacity of stakeholders to improve flood resilience and enhance flood risk governance, including collective decision-making by:

- increasing flood literacy;
- fostering social learning;
- creating a safe space for exploring both risk management and communication strategies.

In its mechanism, the FRC game brings people together to work through simulated flood-preparation scenarios and better understand the perspectives of various stakeholders (politicians, farmers, insurance companies, and so on). Players do so by choosing a stakeholder role and making decisions based on that stakeholder's interests and goals. Each game round consists of four phases as players: 1) plan for different types of flooding; 2) reevaluate their past decisions after a flooding event; 3) evaluate their budgets to reflect any damages; and 4) cast votes indicating their confidence in the game's politicians. Afterward, players debrief about their strategies and experiences, providing further opportunities for learning.

The game aims to enhance flood resilience by addressing key problems present in Canada's FRM and to mobilize the potential for innovations. To shift away from reliance on traditional physical infrastructure, the game introduces sustainable and noninfrastructure (soft) solutions such as relocation and bylaws and is based on Canada's regulatory and financial systems. Furthermore, the game provides a safe space for players to explore different ways of interactions, allowing them to learn about the benefits and challenges of collectively finding solutions that meet the criteria for social and responsible innovation such as efficacy, sustainability, and equity.

Since the FRC game's inaugural in-person session in 2019, the FRC team has delivered multiple online sessions to a range of audience members including engineering and resource management students, water management professionals, regional government officials, residents, and NGOs. An online version was piloted at ISTAS 2021 to showcase the effectiveness of the game with professionals. During the debrief, participants realized the importance of identifying similar goals amid competing interests and using a "future-based" approach to prioritize long-term benefits to protect the majority of stakeholders.

The FRC offers a promising strategy as an educational and engagement tool in diverse contexts enabling individuals in universities, governments, the private sectors, and more at both local and national levels to better understand how the complexity of flooding requires an adaptable multipronged approach. The game can also be used to enhance awareness, preparedness, and responses to disasters. For more information about FRC and implementation in diverse settings, visit frcgame.com.

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