Serious Gaming to Explore and Investigate Disaster Recovery Gaps

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Abstract

- Purpose: To understand the potential of serious gaming as an imaginative and creative method to collect data in disaster studies that addresses key concerns such as extractive research, power inequalities, and bridging the theory-practice gap in exploring post-disaster recovery.
- Design/methodology/approach: Novel serious gaming approach deployed to connect theory-practice by identifying and co-analysing post-disaster recovery gaps in a workshop setting.
- Findings: The serious game has value in bridging theory-practice divides, identifying and exploring gaps/solutions in post-flood recovery, and as a novel social science research approach for disaster studies.
- Originality: The paper proposes a creative and co-developed serious game method of data collection for disaster studies
- Practical implications: Outlining a dialogic approach to knowledge construction between academics, practitioners, policymakers, and community voices on post-disaster recovery.
- Social implications: Fostering collaboration and knowledge construction on post-disaster recovery gaps across stakeholders is valuable in improving disaster resilience strategies that benefit communities affected by disasters.

Introduction

Disaster recovery is a nebulous process that starts at different points, is multi-scalar, often non-linear and can last years after the disaster event itself (Davis & Alexander, 2016; Tierney & Oliver-Smith, 2012; Quarantelli, 1999; Whittle et al., 2010; Wisner et al., 2004). Whilst sometimes overlooked, the recovery process is an essential part of disaster management that will influence the fate of disaster-affected communities and the future disaster risk they face (Winkworth, 2007; Tierney & Oliver-Smith, 2012). This paper focuses on understanding the potential of serious gaming as an imaginative and creative method to collect data in disaster studies that addresses key concerns such as extractive research, power inequalities, and bridging the theory-practice gap in exploring post-disaster recovery.

Recovery can focus on returning to the pre-disaster status quo as quickly as possible and in doing so rebuilding or even exacerbating the vulnerabilities that existed before, and perhaps even contributed to, the disaster (Fernandez & Ahmed, 2019; White & O'Hare, 2014; Wisner et al., 2004). This is not only limited to the physical environment with recovery interventions that fail to acknowledge power relations potentially reproducing existing risk by maintaining or even perpetuating the social production of disasters (Oulahen, 2021; Pyles, 2017). Individuals and institutions with powerful voices can exert their influence in returning to their pre-disaster state in ways that are not always acceptable to those affected (Quarantelli, 1999; Tierney & Oliver-Smith, 2012) and potentially at the expense of communities with weaker social ties and a lower ability to influence post-disaster interventions (e.g. Aldrich & Crook, 2008). Alternatively, the disaster recovery process can engage with the social production of disasters in order to address pre-disaster

vulnerabilities to build back better through incremental adaptations or through radical shifts in the status quo (Forrest et al., 2019; Kelman, 2022; O'Keefe et al., 1976; McClymont et al., 2020). The latter can reshape relationships between the hazard and society, challenge existing power relations (and those individuals/organisations with responsibilities and resources for disaster recovery), and empower residents with an emphasis on voices that are often unheard.

Learning is an important part of disaster recovery and there is a need to seriously and critically reflect on disaster events and to adapt plans (Birkland, 2009; Kelman, 2022; Liao, 2012; Tierney & Oliver-Smith, 2012). This should draw on a wide range of actors with previous disaster recovery experiences and expertise, through which theory, practice and lived experiences can come together. These post-disaster gaps could come in the form of a problem, knowledge deficit or an unresolved question that affects post-flood recovery. To address these disaster recovery gaps, there is first a need to identify them, define and understand them, prioritise them, and then explore potential solutions and resource needs. Identifying gaps in disaster recovery can be challenging due to the emerging and competing challenges arising from the disaster aftermath. For example, gaining buy-in from relevant actors without fear of repercussions of honest organisational introspection, and moving beyond extractive disaster recovery research to bring value to these actors. The research was sensitive to these issues of power, including of the potential for extractive research, by working with players to identify and analyse data that is shared during the workshops as part of developing more “respectful, reciprocal and genuine relationships” in advancing disaster studies research (Disaster Studies Manifesto, n.p.). Failing to address these challenges in identifying and exploring these disaster recovery gaps can lead to a loss of knowledge and a missed opportunity for post-disaster learning.

This paper focuses on exploring and investigating disaster recovery gaps in the context of flooding through the use of a serious game. The serious game (“The Flood Recovery Game”) has been designed to be playable across different cultures with the context-specific details emerging through the storytelling approach employed. It was developed as part of the *Mapping Flood Recovery Gaps Project* that aimed to co-identify gaps, and potential solutions, in post-flood recovery by drawing from the knowledge and experiences of stakeholders in the East Riding of Yorkshire and its largest city of Hull . This area of the UK has a long history of flood events, suffered major flooding in 2007 and 2013, and identifies flooding an important policy concern that needs addressing (Hull City Council, 2022; McDonagh et al., 2024).

This paper first provides an outline of the serious game on post-flood recovery before discussing its deployment in a workshop setting with a selected group of relevant actors and community members from within Hull and the East Riding of Yorkshire . Results and discussion on using the game to gather relevant experiences and knowledge on post-flood recovery are presented as are the co-analysed data to prioritise the gaps, identify solutions, and associated needs. The value of deploying a serious game to explore post-flood recovery is then discussed as is the potential of the serious game as a creative research method within disaster studies.

A Creative Method for Disaster Studies: The Flood Recovery Game

Reflexive, creative and critical research methods can potentially play an important role in identifying, exploring and investigating post-disaster recovery gaps. There is a recognition that social scientists working on disaster studies employ a variety of different methods with the case study approach, survey research, and in-depth interviews being commonly used in data collection (Peek et al., 2020). However, these more traditional methods are not always able to bring together a range of stakeholders into one space to explore and discuss topics together in real-time. An opportunity

exists in combining these commonly used methods, such as interviews, as part of more participatory approaches that challenge existing power structures, collaborate more closely with research participants in identifying context-specific and participant-based solutions, and in bridging theory-practice in initiating change (Knott et al., 2022; Le De et al., 2015).

Serious gaming has been used across many disciplines, such as education and environmental management, and can be understood as games that go beyond only providing entertainment value (Abt, 1970; Flood et al., 2018). These constructed environments can simulate real-world problems and aim to provide an opportunity for players to make mistakes without real-world consequences. These games can be fictional or based on real-world contexts, include mechanisms (e.g. point scoring, rules etc.) that provide stimuli to help players navigate the game as well as challenge them, as well as providing players with feedback based on gameplay choices (Douven et al., 2014; Forrest et al., 2022). Serious games have been developed for capacity-building, awareness raising, and empowerment of players (Bokhove et al., 2020; Flood et al., 2018) as well as to test hypotheses (e.g. willingness to pay, Arnal et al., 2016). The use of serious games in disaster studies is growing with the potential to engage and teach diverse audiences in disaster management (Solinska-Nowak et al., 2018), such as 'STOP DISASTERS!' game (UNDRR, n.d.), which is freely available and has been used in teaching in schools (e.g. by Felicio et al., 2014). Serious gaming can be a creative approach to both provide benefits to participants and collect data within disaster studies. However, it has not been applied equally across hazard type with floods, earthquakes and droughts receiving greater attention (Solinska-Nowak et al., 2018), nor across disaster phase with a review of flood games reporting the majority focusing on preparatory actions and very few on during or after the flood event (Forrest et al., 2022).

This paper contributes to these discussions through the "Flood Recovery Game", which was developed using evidence from a systematic literature review on the topic of post-flood recovery, a review of 36 UK-focused policy reports as well as 26 semi-structured interviews that focused on post-flood recovery in England with particular reference to Hull and the East Riding of Yorkshire. These three sources of data were used to understand common issues in post-flood recovery, actors involved in post-flood recovery, and to identify post-flood scenarios for use in the serious game.

Discussions in the aftermath of disasters can be challenging and lead to actors attempting to avoid accountability and blame being apportioned through the media reporting (Straub, 2021). In the context of flood disasters in England, these discussions on responsibility and accountability have been directed towards government, farmers, and councils for lack of leadership, maintenance choices, river capacity (e.g. dredging), agricultural management, and lack of resources and support (Albrecht, 2022; House of Commons, 2024; Mehring et al., 2018; Thorne, 2014). This apportioning of blame, both fairly and unfairly, can lead to an unwillingness of relevant actors to engage in discussing their actions in previous flood events and/or to become defensive of their organisation's response. The game design attempted to overcome this by using a neutral, fictional environment for players to explore post-flood recovery, as done in other serious games to avoid any "real-life sensitivities" between actors (e.g. the Shariva game, *see* Douven et al., 2014:1435). Using characteristic stakeholder roles as opposed to named real-life roles and by valuing a diversity of experiences and expertise in the game design, the game aims to reduce power imbalances between players.

The serious game was iteratively developed with feedback from members of the project Advisory Board (consisting of a representative from Hull City Council, East Riding of Yorkshire Council, Humber Emergency Planning Service, Association of British Insurers, GJB Consultancy-Oxford Ltd, Environment Agency, and Aviva) and through 3 pilot sessions with 9 participants in total. The game

was piloted with an audience bringing diverse levels of experience and engagement with flood risk management. Working with the Advisory Board enabled us to trial different content elements on post-flood recovery whilst the pilots groups enabled data collection approaches to be tested and modified as necessary. These pilot sessions used paper print-outs to test the accessibility and player response to different game designs. The final game design was created working with a designer and in consultation with the researchers, project Advisory Board, and pilot participants as well as individuals with marketing experience. This aimed to ensure high production standards in the deployed version as a way to convey to participants that this was a credible exercise. Through this iterative development process, elements of the game were decided upon such as the actor cards, 12 post-flood scenarios, and the resource cards that were most appropriate. A challenge was in deciding upon the actor cards due to the fragmented nature of flood risk governance in the England partly as a result of the diverse flood risk management strategies employed (Hegger et al., 2016). The challenge in the multiplicity of actors involved also applied to the selection of resource cards. The trade-off between verisimilitude (i.e. simplified reality vs modelled complexity) and playability is acknowledged in the development of serious gaming (*see* Aubert et al., 2018). A choice was made to make these cards deliberately imprecise with broader groups of resources used (See Figure 1) with participants then invited to elaborate on the nature of these resources as the game develops.

FIGURE 1: The finalised game board and associated cards

The resulting Flood Recovery Game is a story-based approach in which players engage with a specific pre-selected post-flood scenario and then construct their own 'plan of action' on how to respond to the scenario drawing from their own professional and/or lived experiences of flooding and flood recovery. Players are prompted by the resource cards they have in their hand and which they use in constructing their 'plan of action'. Players are given time to think about the scenario and their own ideas before each player is given an opportunity to describe and explain their 'plan of action' for the other players using the resource cards they need to execute it. There is then time for any questions from other players. The next player clockwise then does the same and this is repeated until all players have shared their 'plan of action'. Facilitators support the process and ensure that each player has time to share their ideas. Players are encouraged to incorporate the ideas they have heard from other players into their own plans. This supports peer-to-peer knowledge sharing and the plans grow in detail as the round continues. After each player has shared their plan, there is a secret vote where players vote for the plan that they prefer but cannot vote for their own plan.

Players moved their wooden pawn along the orange pathway across the board as they gained points on their journey to the top-right part of the board.

Methodology

Data were collected through the serious game and the associated workshop activities afterwards in a day-long workshop held on 'Mapping Flood Recovery Gaps' in 2022. The workshop focused on post-flood recovery in Hull and the East Riding of Yorkshire. Individuals with expertise and/or experience in post-flood recovery and/or a relevant role at an organisation involved in post-flood recovery were invited. It was important to reach a broad range of stakeholders in the state, civil society and private sectors. A total of 33 individuals attended representing communities and organisations, including the Environment Agency, Aviva Insurance, Hull City Council, East Riding of Yorkshire Council, North East Lincolnshire Council, Venn Academy Trust, KCOM, Humber Emergency Planning Service, NHS Healthcare, Yorkshire Water and University of Hull. Attendees were organised into 5 groups in advance of gameplay with the aim of including a diverse range of players in each group relating to knowledge of flood risk management and experience of flooding. Skilled facilitation is an important element for serious gaming (Flood et al., 2018) and there was a facilitator for each group and one roaming facilitator to support consistency across gameplay and co-analysis across the groups, all had received training in advance of the workshop.

The serious game was used to collect data through players' identification of gaps in post-flood support and by their choices when responding to flood incident scenarios (Figure 2). The facilitator encourages players to write down these questions and uncertainties on post-it notes that are then placed on a nearby board for their specific group. In some cases, fellow players are able to answer the questions or provide further details. As each 'gap' is identified, the group are encouraged to press a buzzer that emits a loud noise. This is done to foster a competitive element in the identification of 'gaps' with each group able to see and hear when other groups identify gaps. Participants were at first reluctant to press the buzzer, but then become more eager as gameplay continued. Immediate post-game discussions led by the facilitator allowed further exploration of the identified gaps and for additional gaps to be added. They also provided an opportunity for players to reflect on the gameplay as well as to collect data on players' experiences of the serious game. Collecting data in these ways enabled player's stories and real-life experiences to be captured in addition to the choices they made.

The Flood Recovery Game enabled workshop attendees to discuss post-flood scenarios and share gaps that were written down on the post-it notes. A co-analysis approach was adopted whereby the workshop participants stayed in their groups and reviewed the gap data they had collected in a session after gameplay, as opposed to researchers later analysing the data alone. After this, the researchers introduced additional gaps that had been identified through the systematic literature review in other geographic contexts to the groups. Each group read through the gaps and reflected on their applicability to their own experiences. In some cases, these gaps were amended and adopted by the groups, in other cases they were discarded as the group members deemed them not to be relevant. At the end of this first post-game exercise, each group had a set of gaps that they thought were most appropriate based on their experiences of flooding and post-flood recovery in Hull and the East Riding of Yorkshire.

Each group was then asked to discuss and prioritise their gaps, before identifying solutions, and associated needs. At the end of these activities, the participants of each group had worked together, supported by the same facilitator from their gameplay, to prioritise the gaps and identify the solutions and needs. There was a feedback session at the end of the workshop where groups could

share their gaps, solutions and needs to enable knowledge and idea sharing. Additionally, a post-workshop survey was completed by 19 participants with questions focused on key gaps and solutions identified as well as on their experiences of the serious game.

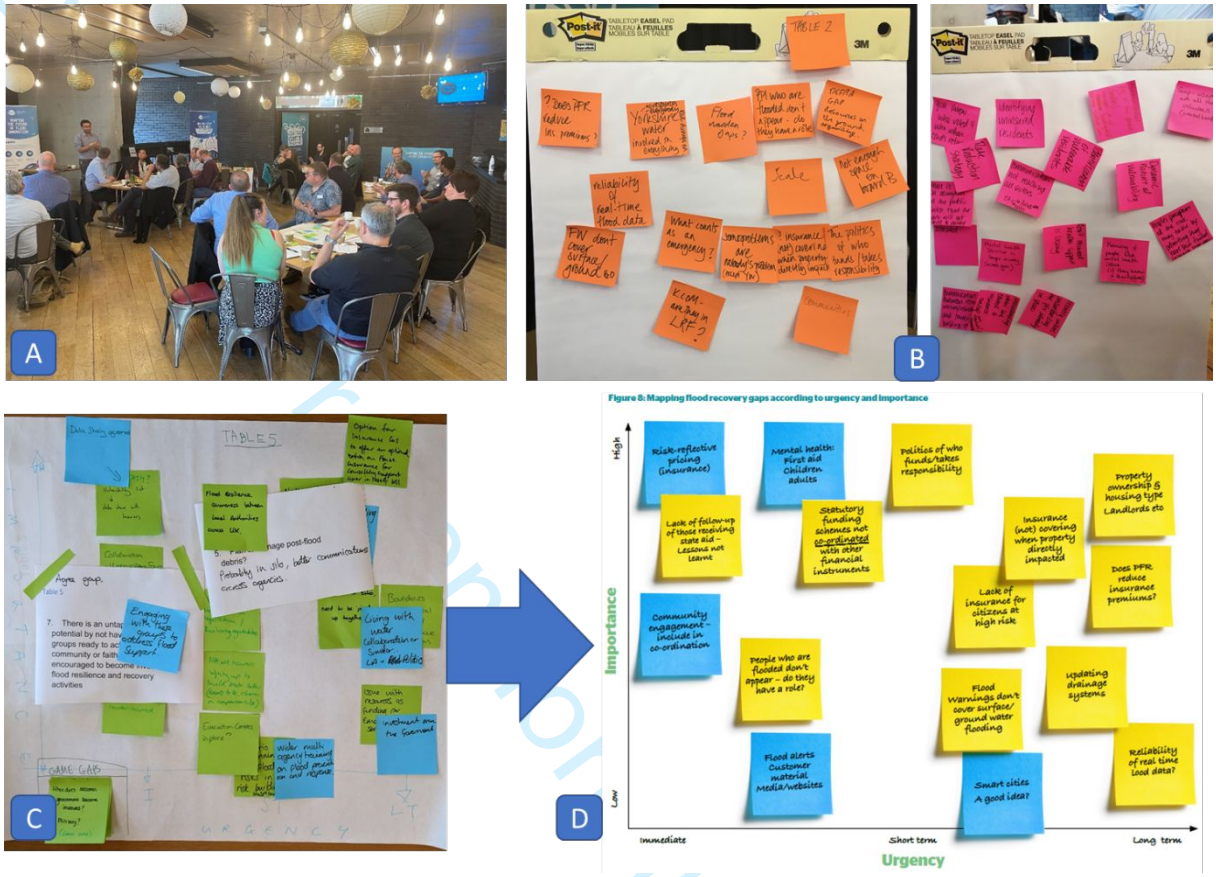

FIGURE 2: A) Group layout, B) Identified gaps from two tables, (C) the prioritisation of gaps and suggested solutions, (D) and from several tables

Results: Mapping Flood Recovery Gaps

Identifying post-flood recovery gaps

Participants identified 69 gaps on the post-it notes, which consisted of perceived gaps on post-flood recovery. A 'gap' could have come in the form of a problem, knowledge deficit or an unresolved question that affects post-flood recovery. Examples of these from the workshop included: 'Lack of accountability in decision-making' (problem), 'unable to identify the most vulnerable people' (knowledge deficit), and 'does property flood resilience reduce insurance premiums?' (question).

Key themes emerged around stakeholder involvement and collaboration (19 gaps across 5 tables), funding (13 gaps across 5 tables), health (13 gaps across 3 tables), preparedness (10 gaps across 3 tables), and data availability (9 gaps across 5 tables). Further issues were in the definitional fuzziness of flood emergencies (e.g. an emergency or not), recovery options (whether recovery workers understood the property flood resilience measures already in place, and the local recovery needs) (Figure 3).

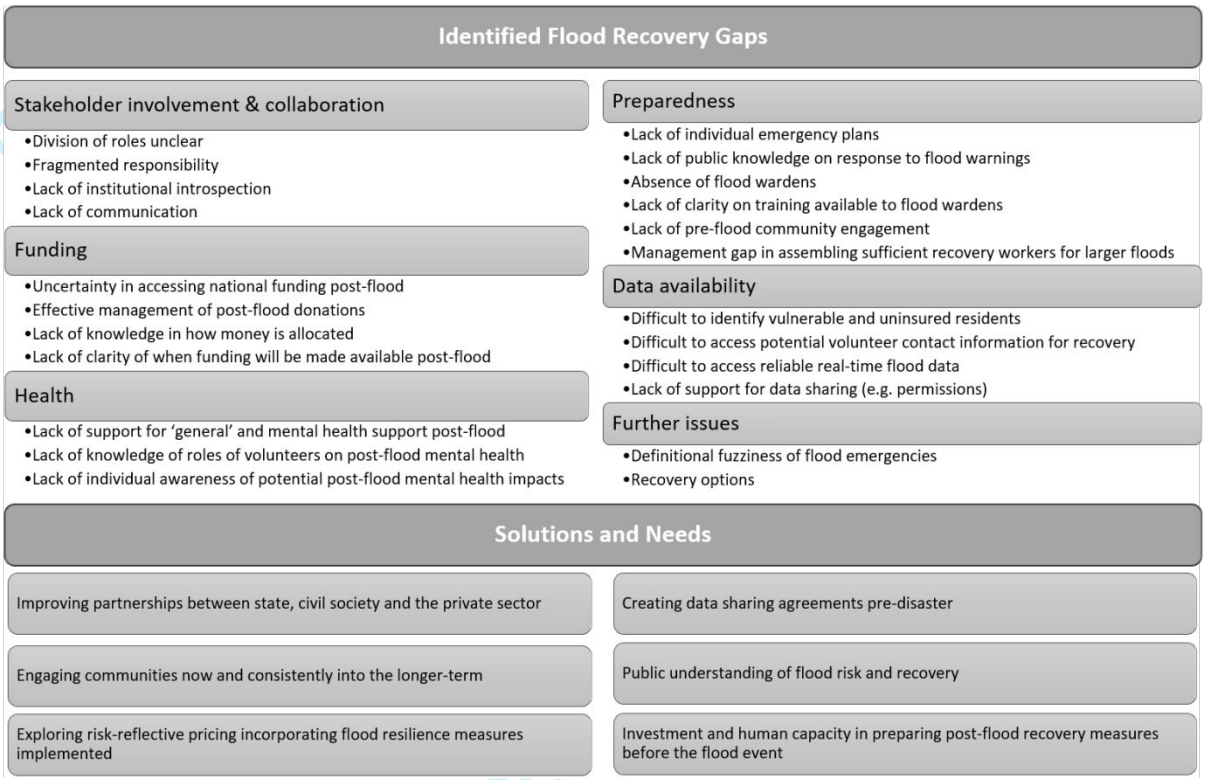

FIGURE 3: Identified Flood Recovery Gaps, Solutions and Needs from the workshop

Stakeholder involvement and collaboration gaps were most prominently identified in terms of the division of roles, fragmented responsibility and institutional introspection in post-flood recovery, such as the boundaries between local authorities and emergency services as well as communication between NGOs and authorities, which was summarised by one participant as "*some problems are nobody's problem*". Funding was another theme that emerged across all five tables with problems in accessing national funding post-flood and in managing post-flood donations, a lack of knowledge of how money is allocated and a question of when funding will be made available. A health theme clustered around 'general' health and mental health; mental health was very prominent in discussions across all tables with a lack of both mental health support and knowledge of the role of volunteers and coordination between actors on post-flood mental health, as well as individual awareness of potential mental health impacts post-flood identified. Preparedness gaps were identified at the individual level in terms of a lack of emergency plans and being unsure of actions needed in response to flood warnings. At a neighbourhood level, preparedness gaps identified were the absence of flood wardens and a lack of clarity on training available to them, lack of pre-flood community engagement, and a gap in assembling sufficient recovery workers for large flood events. Data availability gaps focused on identifying vulnerable residents, uninsured residents, and contact information of potential volunteers to support in the recovery as well as accessing reliable real-time flood data. Data sharing was identified as problematic in terms of permissions, different data formats, levels of access, and when wanting to share data about specific vulnerable residents.

Prioritising Gaps

Having worked on their own identified gaps, participants then read through a list a post-flood recovery gaps (approx. 8/table) that had been identified from the literature review and discussed whether they were relevant in Hull and the East Riding of Yorkshire context and, if so, to give greater details on them. This was part of the co-analysis and to connect theory to practice by facilitating

attendees (i.e. those with knowledge and expertise) to decide whether the literature-based gaps identified internationally were relevant to the 'local'.

These new gaps also stimulated further discussion on the game-identified 'data availability' gaps with one group engaging with the literature-based gap "Lack of criteria to define vulnerable people, specifically in the context of health and wellbeing. This means that actions might not respond to needs". The discussion led to a realisation that the one emergency service held this information in the form of vulnerability lists, but did not routinely share it with other agencies who were not aware that the list existed. The participants then discussed their chosen gaps and ranked them by their urgency (along an x-axis of immediate, medium-term, longer-term) and their importance (along a y-axis of low, medium and high) on flipcharts.

Solutions and Needs

Participants then worked together in their groups to identify potential solutions and the associated needs to enact the solutions. These led to energetic discussions with participants exchanging ideas and then writing down agreed responses. These solutions included i) actions requiring the involvement of (and partnership between) different stakeholders from the state, civil society and private sector to better collaborate and communicate, ii) the importance of engaging the voluntary sector and community engagement now and consistently into the longer-term, and iii) the potential shifts in creating data sharing agreements and in risk-reflective pricing that incorporates property flood resilience measures implemented.

There were differences of opinion in prioritising, such as mental health being important and long-term by one group and then of low importance and for the long-term by another group. Furthermore, the post-workshop survey revealed a diverse set of perspectives on priority areas for action amongst participants. Stakeholder engagement was the most prominent as 25% (n = 16) of the participants commit to exploring opportunities for collaboration and improving community involvement in flood recovery discuss. Furthermore, training of communities and actors, collaboration initiatives, and community engagement activities are each cited by 13% (n = 16). Participants intend to also prioritize property flood resilience and other prevention measures.

During the workshop, participants identified actions that they could readily take in order to begin to address post-disaster recovery gaps identified. In terms of stakeholder involvement and collaboration, as well as data sharing, a council representative and insurance representative recognised that they could potentially share details of those insured and work together to better identify the most vulnerable residents in conjunction with COVID emergency hubs. Another example is for preparedness, where a private sector representative identified that they did not have flood risk information for elements of their infrastructure and therefore wanted to conduct an asset review.

The response to a serious game approach

There were three gameplay variations as part of a transition from competitive to semi-collaborative player-interactions and these were positively received according to player feedback and facilitator notes. Variation 1 allowed players to become familiar with the gameplay process and the recording of gaps using post-it notes and the buzzer. Variation 2 added an element of chance into the game with unpredictability in resources for future scenarios whilst participants reported that the gameplay in Variation 3 was closest to reality with insufficient resources and the necessity of collaboration reflecting their lived experiences.

In terms of cards and game design, the scenarios were described as 'quite realistic' and appropriate in multiple groups in facilitator feedback and notes, whilst still posing stimulating questions for players. The resource cards were beneficial in their deliberate imprecision, but some players wanted further information in terms of the amount of each resource. There were suggestions to include additional cards such as for 'utilities and infrastructure', 'media' and to explore whether the private sector and 'big business' could be represented as a resource in post-flood recovery.

The serious game was well-received by workshop participants with the novelty of the creative approach capturing the imagination of players and receiving many positive comments during the game and afterwards. Facilitators reported that players became highly engaged in the fictional gameplay scenarios and in developing the best plan of action (on their own or in collaboration with others) as well as enthusiasm in trying to identify gaps and press their table's buzzer. There were positive comments about the game captured when participants reflected on their workshop experience in their feedback forms:

"Very enjoyable and engaging, [I] like the hands-on approach" (Private Sector Representative 1)

The serious game aimed to encourage a dialogic approach to post-flood recovery knowledge construction between academics, practitioners, policymakers, and community voices. In the post-workshop survey, 42% of participants (n = 19) found engagement and collaboration through gaming to be their primary takeaways, emphasising the importance of interactive activities in fostering cooperative learning environments:

"Great to connect with colleagues across many organisations who are working on the issue" - (Public Sector Representative 1)

In the post-workshop survey, 32% of participants (n = 19) emphasised knowledge acquisition as a key outcome, gaining a deeper understanding of recovery disparities and the diverse roles and challenges faced by stakeholders, particularly insurers. The open-discussion format of the serious game encouraged players to build on each other's ideas and extend them by incorporating their own knowledge and experiences:

"The more diverse the group, the better the discussions during the game" - (Public Sector Representative 2)

The deliberate inclusion of a diverse range of stakeholders in the workshops also led to exchanges of ideas with people able to provide immediate answers to gaps where there was uncertainty (e.g. when players were uncertain of who is responsible for a certain task in real-life) in a form of real-time peer-to-peer learning.

Participants were positive when asked whether they wanted to continue follow-up activities in the post-workshop survey with 89% (n = 19) participants signalling that they wanted to attend future events and workshops on this topic with 42% of this number indicating interest in engaging in policy note development and the same wanting to be contacted for further research. Other ideas suggested for future discussion by participants were joint projects on post-flood recovery and capacity building using serious gaming approaches.

Discussion: Addressing Key Concerns?

Bridging the theory-practice gap in exploring post-disaster recovery?

The serious game and workshop approach brought together a range of different actors involved in post-flood recovery in Hull and the East Riding of Yorkshire. They engaged with the game and identified gaps based on their professional and lived experiences of flood recovery. It was a more creative and imaginative approach to data collection that incorporated academic theory through the serious game and connected to practice and lived experiences through the storytelling approach.

In analysing the themes that emerged during the serious game and workshop, the post-flood recovery gaps identified in the wider literature relate to this local context. For example, the importance of civil society and governance after disaster events (Aldrich, 2012; Tierney & Oliver-Smith, 2012) emerged through discussions on stakeholder involvement and collaboration, and of the importance of mental health (e.g. Twiddy et al., 2022) and associated impact of insurance on mental wellbeing in the post-flood recovery (e.g. Foudi et al., 2017). Disasters, such as flooding, can be emotional topics for those affected and serious gaming could offer an opportunity to engage individuals in these discussions to both support them to process their disaster-based experiences as well as to reflect on potential actions to increase disaster resilience, as has been investigated in end-of-life healthcare discussions (see Liu et al., 2023).

The deliberate imprecision of the resource cards and scenarios enabled discussions over 'who should be involved in post-flood recovery?' and over associated resourcing. It led to questions on roles and responsibilities with much discussion generated over the difference between a 'council worker' and a 'recovery worker'. This deliberate imprecision could facilitate the use of the serious game in other geographic locations (with different sets of actors and divisions of responsibilities) and beyond for other hazard types beyond flooding.

Beyond extractive research?

The research was sensitive to issues of power and of extractive research whereby researchers come in to collect data and then take this intellectual capital to analyse and present to funders (Gaudry, 2011). In response, we aimed to work with players throughout the process to develop new (and existing) relationships that involved various forms of 'co-' working, with the paper referring to co-development, co-identification, co-analysis, and co-creation. These refer to the relationships and collaborations between researchers and players that existed over the research process, with researchers leading the game development and providing structure to the workshop, but the analysis then being led on tables by players with researchers playing a secondary role and encouraged peer sharing of ideas at the end of the workshop. Through this, findings emerged throughout the workshop that participants shared as opposed to participants only seeing the results later in publications

The dialogic approach of the Flood Recovery Game had value in starting discussions and, through the game design, being sensitive to issues of power between players by helping to reduce the power inequalities between those around the table. The use of a fictional environment encouraged critical reflections and the structure of each round allocated each player time to contribute their ideas whilst also allowing discussions in the later activities. The discussions in the serious game had similarities to focus group discussions in that they captured evidence from multiple relevant stakeholders in a format that allowed participants to contribute to, extend further and even contest the answers given by fellow participants. We observed the potential for empathy building and peer-to-peer knowledge exchange by connecting actors with a role in post-flood recovery to those

previously affected by flooding, although this was not measured. Further dialogue with these participants and with other communities could potentially support learning and adopting policies to increase resilience to future events (Albright & Crow, 2015) and encourage social learning (Flood et al., 2018), but it is important to keep responsible actors in those conversations to try to influence policy and practice.

Challenges and Limitations

There were limitations and challenges in the data collection approach as the game pilots focused on a single group playing the game in relatively quiet surroundings and enabled audio recording. However, there were challenges with recording audio in such an interactive (and noisy) environment in addition to difficulties in both making notes and actively facilitating discussions. The specific themes were captured at the end of the discussions and gameplay; however, future gameplays could attempt to record the order of the gaps to analyse how the discussions evolved over the course of the gameplay and in response to which scenario.

A challenge is of participant reluctance to play games. There was an initial sorting as those who accepted our workshop invitations did so knowing that there was a game element. There was a high conversion rate in terms of attendees accepting invitations and some reported that the novelty of a serious game on flooding attracted them when they would otherwise be hesitant to dedicate this amount of time to a workshop. Facilitators reported that some participants who initially appeared cautious about engaging with the exercise became increasingly involved and committed as the game play progressed, with their reservedness reducing visibly.

Conclusions

Serious gaming has been explored as an imaginative and creative method to collect data in post-disaster recovery. There are three key conclusions relating to the value of a serious game to engage with post-flood recovery, its generalisability for other locations and hazard types, and its value as a creative research method for disaster studies.

Firstly, the open-discussion format of the serious game encouraged players to build on each other's ideas and extend them by incorporating their own knowledge and experiences. Due to the diverse range of stakeholders participating in the workshop, it also led to exchanges of ideas with players able to provide answers to others in a form of peer-to-peer learning. The serious game approach aimed to be a more participatory method and did attempt to address power inequalities, co-analyse data to prioritise gaps identified by participants and the associated needs as well as bridging theory-practice. It was however limited in instigating change, a key element of participatory research (Le De et al., 2015), although it is a start at bringing actors together to support direct dialogue and the raising of place-specific issues as gaps that can be addressed. Future research already underway in a Phase 2 of the project will attempt to further develop this by investigating how to better tailor the game to specific stakeholder groups and how the outputs can be more closely linked to influencing policy. Further research could investigate the potential role of serious games, like the Flood Recovery Game, to support communities in processing disaster experiences and planning for future actions (similar to that done in end-of-life healthcare discussions, Liu et al., 2023).

It is also important to acknowledge that serious gaming is not always possible or appropriate as a means of data collection and that there are many creative gambles involved. We (the authors) have been extremely fortunate to have funding, and the university as a safety net, in designing and deploying this creative research method. There have been many potential risks of it going wrong that have kept us awake, for example players not attending or not participating in the game, a game

that was too simplistic and far from reality vs being close to reality but too complex to play, a game that entrenched inequalities by not making space for players to contribute, or a game that was too competitive and had a 'Monopoly-type effect' of disrupting established relationships and someone knocking the board off the table during gameplay.

Secondly, there is potential for the serious game to be applied to other locations and hazard types to stimulate discussions on gaps, solutions, and needs in post-disaster recovery. This project did not collect data on generalising the serious game further in different contexts to explore potential cross-cultural (and hazard) applicability and future research is needed to address this limitation. However, the game has already been successfully used as a teaching tool on flood recovery for MSc students at the University of Hull and University of Copenhagen suggesting that this form of cross-cultural use is possible. The deliberate imprecision and storytelling approach allow the game to be played in countries with different approaches to flood recovery (e.g. with different government actors and responsibilities) and it does not need to be played in English (although some cards would first need translating). There is the potential to extend this game to other hazard types and to also develop the game further to apply to multiple and cascading hazards. However, it is important to ensure that future use of the serious game incorporates meaningful engagement and co-creation, and is not simply used as a standalone activity that then ticks boxes for citizen engagement having been done.

Finally, this proposed use of serious gaming could be a creative, participatory approach to conducting research *with* participants as opposed to extracting research *from* participants. This paper's serious gaming approach can therefore contribute to supporting more balanced relationships between researchers and participants that support lived and professional experiences playing a larger role in advancing disaster studies (*see* Disaster Studies Manifesto, which calls for a change in priorities, values and relationships to disaster studies). The co-analysis of the data (i.e. the prioritising gaps) and the discussion of potential solutions and associated needs also supported collaboration between practitioners, policymakers, community members and academics engaged in or with experiences of post-flood recovery. In doing so, this approach used theory through the serious game to engage participants in reflecting on their existing practice. The outcomes are feeding back into theory (through academic publications) and into practice (through experience sharing in the workshops and the workshop report (De Ita et al., 2022)). Serious gaming in a workshop setting could therefore be a valuable addition to bridging the theory-practice gap in post-disaster recovery and could be a new avenue for encouraging co-discovery in disaster studies.

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Figure 1: The finalised game board and associated cards

808x391mm (59 x 59 DPI)

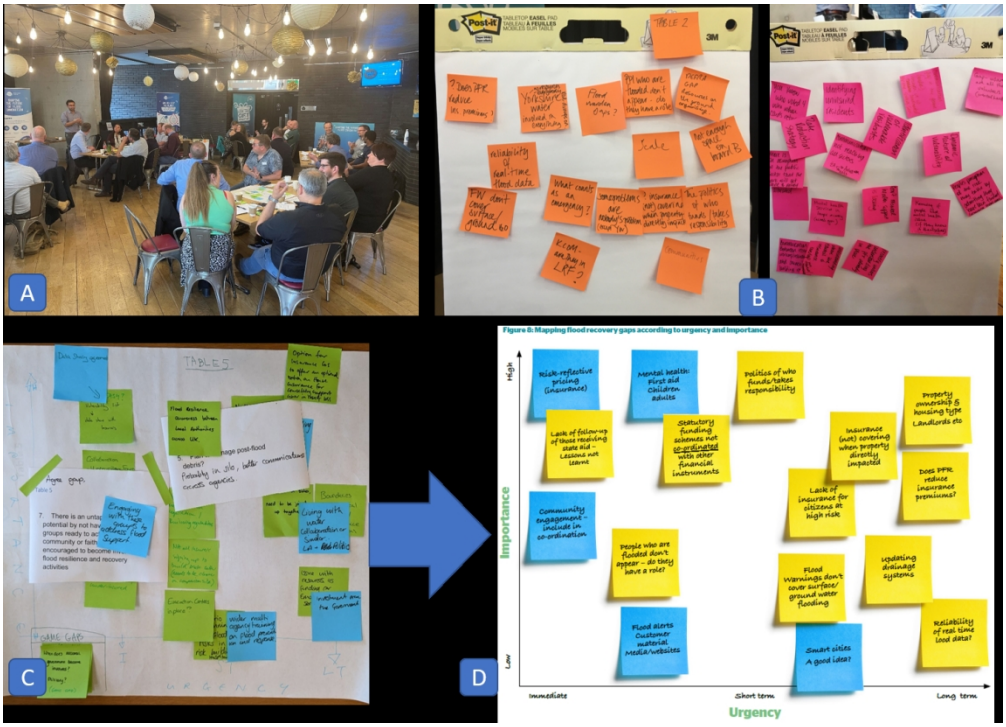

Figure 2: A) Group layout, B) Identified gaps from two tables, (C) the prioritisation of gaps and suggested solutions, (D) and from several tables

644x462mm (59 x 59 DPI)

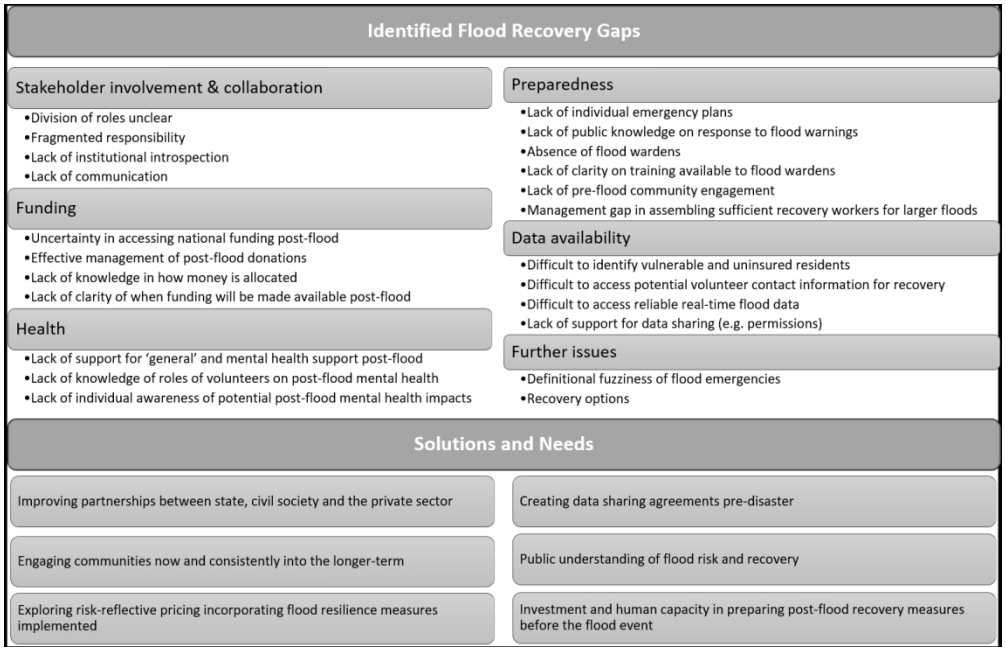

Figure 3: Identified Flood Recovery Gaps, Solutions and Needs from the workshop

675x434mm (59 x 59 DPI)

Title Page (Containing Author Details)

Serious Gaming to Explore and Investigate Disaster Recovery Gaps

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