



APPLICATION OF DESIGN PROBES TO FOSTER CHILDREN'S CREATIVE PARTICIPATION IN DISASTER RISK REDUCTION

Mojan Mosavat

A thesis submitted in fulfilment
of the requirements for the
degree of
Doctor of Philosophy in Design
and Creative Technologies,

Auckland University of
Technology,
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ABSTRACT

Historically, children have been considered a vulnerable and less vocal group in disaster risk reduction (DRR). Their limited involvement has often been attributed to physical and psychological vulnerabilities, which has resulted in an underestimation of their potential contributions to disaster preparedness. Despite these vulnerabilities, children possess imagination, adaptability, and fresh perspectives that can influence disaster preparedness in ways that adults may not. While there is an increase in research aimed at involving children more actively in DRR, challenging traditional top-down approaches, there is still a growing need to explore new ways to engage them.

This research aimed to explore how design probes could be used to harness these qualities in children, encouraging meaningful participation and agency in DRR activities. Design probes, which are traditionally used to gain insights into people's everyday lives and perspectives, were adapted and applied in this study to actively engage children in DRR processes. This involved designing, prototyping, and refining a series of playful and narrative-driven activities that enabled children to explore disaster preparedness creatively and personally. The probe tool in this study is called Kit, a name with twofold significance: it refers to the probe 'kit' or package, as mentioned in the literature on probes, and to the character 'Kit,' created to be embedded in the probe booklets to guide participants through the activities. Kit served not only as a tool for gathering data on children's perceptions and knowledge of DRR but also involved them in the co-design of the probe activities to ensure they aligned with their experiences and learning preferences. Through this iterative process, informed by participant feedback, a set of engaging and meaningful activities was developed, connecting disaster preparedness to children's daily lives in a tangible way.

The study's findings demonstrate that design probes can offer a unique and flexible approach to DRR education, moving beyond traditional top-down

approaches such as school drills and standardised procedural instructions for emergency responses. Children in the study demonstrated a strong ability to articulate their understanding of disaster risks, with many expressing a shift in perception from seeing disasters as uncontrollable events to recognising preparedness as a personal responsibility. For example, several participants highlighted that they had never considered their role in emergency preparedness at home before engaging with Kit, but later initiated conversations with their families about evacuation plans and emergency supplies. This creative and interactive approach enabled children to see themselves as active participants in building resilience, contributing to a deeper understanding of disaster risks. Additionally, observations and feedback revealed that hands-on activities and games were particularly effective in helping children retain key preparedness concepts, as they could actively come up with responses rather than merely read about them. The study also identified the need to adapt creative DRR tools to suit children's diverse preferences and backgrounds. Initially, the design probes were developed as physical, paper-based materials. While this approach was effective, some findings suggest that integrating digital components could further enhance engagement and accessibility. Subsequently, a hybrid "phygital" approach, blending physical and digital tools, would not only accommodate children's familiarity with technology but also address practical challenges, such as the loss of physical materials.

Ultimately, this research contributes to the growing understanding of child-centred DRR education, showing that participatory, adaptable methods such as design probes can significantly enhance children's involvement, understanding, and roles in disaster preparedness and resilience-building efforts. These findings have important implications for both policy and practice. By recognising children as active participants, policymakers can shape more inclusive DRR strategies that empower younger generations and ensure their voices and ideas are incorporated into resilience-building efforts. Furthermore, educational frameworks may benefit from adopting similar participatory tools and integrating

them into school curricula and community programmes to create more robust, child-inclusive disaster preparedness initiatives. Such integration would foster a culture of resilience that extends from children to families and communities, ultimately strengthening overall disaster readiness at multiple societal levels.

KEYWORDS

Child participation, Design probes, Disaster Preparedness, Disaster Risk Reduction.

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ATTESTATION OF AUTHORSHIP

hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly acknowledged), nor material which to a substantial extent has been submitted for the award of any other degree or diploma at any university or institution of higher learning.

I acknowledge the use of artificial intelligence tools, specifically Grammarly and ChatGPT-4, solely in accordance with the guidelines outlined in the Postgraduate Handbook (V1.0 – January 2025). Grammarly was used for spelling and grammar checking, while ChatGPT-4 was used exclusively to assist with the rephrasing and restructuring of my own writing. No artificial or generative intelligence tools were used for the generation of novel knowledge, synthesis of ideas, or dissemination of content.

25 March 2025 | Mojan Mosavat

ABBREVIATIONS

CBPR	Community-Based Participatory Research
CDEM	New Zealand Civil Defense Emergency Management
HCI	Human-Computer Interaction
NLP	Natural Language Processing
PV	Participatory Video
RTA	Reflexive Thematic Analysis
SDT	Self-Determination Theory
SFDRR	Sendai Framework for Disaster Risk Reduction
TA	Thematic Analysis
UNCRC	United Nations Convention on the Rights of the Child
UX	User Experience

*"Children are the living messages we
send to a time we will not see"*
– **Neil Postman**



With a keen focus on child participation, this research embarks on a journey that merges the imaginative realms of design with the pragmatic necessities of disaster preparedness, offering a fresh perspective on engaging children as active contributors to Disaster Risk Reduction (DRR). Unlike traditional research instruments that may lead or constrain, design probes thrive on ambiguity, inviting participants, in our case, children, to interact in diverse and creative ways (Çerçi et al., 2021; Mattelmäki, 2006). This study positions design probes not just as tools for data production but as platforms for agency, enabling children to articulate their perceptions, fears, and aspirations regarding disasters, thereby weaving their unique insights into the fabric of DRR (Mattelmäki & Sleeswijk Visser, 2011; E. B. N. Sanders & Stappers, 2014).

Building on the innovative application of design probes, this research focuses on addressing DRR, which stands as a critical area of concern and attention in our ever-changing world, with the increasing frequency and intensity of disasters and human-induced crises (Cutter et al., 2003). Disasters pose significant threats to human lives, infrastructure, economies, and ecosystems (Cutter et al., 2014). Within these challenges, engaging vulnerable groups, especially children, becomes an essential effort as they represent a significant portion of the population and are disproportionately affected by disasters (Peek, 2008a). Recognising children's unique perspectives, experiences, and knowledge can not only strengthen disaster resilience efforts but also empower them as active agents of change within their communities (Mitchell et al., 2009).

The motivation behind this research project is further built upon the realisation that despite the growing acknowledgment of children's rights and their crucial role in building disaster resilience, their potential for meaningful contribution to DRR has been far overlooked and remains limited (Krishna et al., 2022; Ronan, 2016). This is mainly due to the children's physical and psychological vulnerabilities towards disasters often emphasised in the disaster literature

(Peek, 2008a). There is considerable potential to explore the valuable insights and innovative ideas of children, which can significantly enhance the development of comprehensive and inclusive disaster preparedness strategies (Cox et al., 2019).

Within the interdisciplinary fabric of this research also lies a focus on children's participation. The aim of this study was, along with involving children in DRR in a creative and meaningful way, to avoid 'instructional approaches' frequently used in more traditional DRR educational approaches (Cornes et al., 2019; Izumi et al., 2019a). To this end, this study adopts a multifaceted and nuanced understanding of participation, meaning that in the context of this study, participation entails not only the engagement of children in disaster-related activities but also the creation of a platform allowing children to embark on a journey of learning and discovery

The systematic decision to shift away from instructional education in DRR arose from the pedagogical belief that children possess innate curiosity and creativity that can flourish when provided with space for exploration (Engel, 2011; Grabau, 2015). Accordingly, this study sought to spark children's enthusiasm and initiative in the realm of disaster preparedness by incorporating games, playful activities, and creative endeavours. The role of play in this study is particularly important. Engaging children through play not only makes the journey of discovery and learning about disasters and disaster risks more appealing and memorable while enhancing their ability to apply what they have learned in real-life scenarios (Le Dé et al., 2021). Moreover, the focus throughout the design of the study and the decision-making processes has been on empowering children to take ownership of their learning experience to nurture a sense of agency that extends beyond theoretical knowledge (Haynes & Tanner, 2015).

In the realm of DRR, especially in the context of children's participation, the challenge lies in eliciting genuine responses that can provide insights into

children's perceptions, fears, aspirations, and potential solutions (Hore et al., 2018). Given the playful, interactive, and often non-linear nature of design probes, they can be an excellent tool to help access the complex layers of child cognition and emotion (E. B. N. Sanders & Stappers, 2014). Moreover, design probes are not merely tools but also platforms of agency (Mattelmäki & Sleeswijk Visser, 2011; Wyche, 2020). In the context of this study, design probes serve dual purposes. On the one hand, they are instruments to understand, explore, and document children's interactions with DRR concepts. On the other hand, they are more critical platforms that empower and allow children to voice their ideas, express their concerns, and craft solutions that contribute to the bigger picture of DRR.

Design probes in this study have served as the foundational pillars guiding the design of the study all the way through data collection and analysis. The outputs, both quantitative and qualitative, were carefully documented and analysed. This tapestry of data provided insights into child-centric DRR and informed the iterative refinement of the probes themselves, ensuring they remain relevant, engaging and effective throughout this research.

1.2. BACKGROUND AND CONTEXT

The primary focus of this research project is on the convergence of design and DRR, in which the study seeks to navigate and redefine the paradigm of engaging with complex societal challenges. DRR revolves around a structured approach to identify, evaluate, and mitigate disaster risks. Its primary objective is to reduce vulnerabilities associated with socio-economic conditions, physical and mental health, age, gender, cultural norms, and geographical location while addressing environmental and other hazards that act as catalysts for disasters (Cutter et al., 2003; Rahmani et al., 2022). Historically, the strategies employed for DRR primarily followed a hierarchical structure, with decision-making largely being in the hands of adults and experienced specialists (Warner & Dewulf, 2023; C. Wisner & Nivaran, 2003). For example, disaster management efforts were

typically led by government authorities and emergency planners, while community members, including children, were rarely consulted. Similarly, educational approaches often relied on top-down instruction, such as evacuation drills, with limited opportunities for active participation or input from younger demographics. However, over the past few decades, there's been a noticeable modern shift highlighting the importance of involving all members of societies, including the role of children in DRR efforts (Ruiz-Cortés & Alcántara-Ayala, 2020; Yore et al., 2018).

On a different note, children are frequently perceived as the demographic group most susceptible to the adverse impacts of disasters due to their physical and emotional vulnerabilities (Cox et al., 2017; Peek, 2008a). Yet, they have the potential to introduce an array of viewpoints, understandings, and unique insights that can be instrumental to DRR (Anderson, 2005). Children's inherent sense of wonder, imagination, and ability to adapt not only enables them to conceptualise fresh solutions but also gives them the ability to adapt to evolving situations. It is increasingly recognised that children can play a significant role in strengthening individual and community resilience (Fothergill & Peek, 2015). Unfortunately, the dominant belief still exists that children are merely passive receivers of protective measures and actions when it comes to disasters and disaster risks (Pal et al., 2023; Peek, 2008a). This viewpoint often diminishes and underestimates the profound abilities of children to be active agents of change in disaster preparedness and response (Chiu et al., 2022; Ronan & Johnston, 2005).

There is an expanding array of methods in various fields of work that promise to address this oversight. Multiple research studies have involved children in DRR approaches in unique and creative ways to bring out their meaningful participation and inspire them to be active agents of change in disaster-related efforts (De et al., 2020; A. Gampell et al., 2020; Kurniawati & Astuti, 2023). Many studies in the realm of design and creative technologies have also approached

the same goal (Addone et al., 2022; Itenge et al., 2023; Marriott, 2023; Mattelmäki et al., 2016a). Among these valuable and insightful bodies of work, one method that remains relatively under-explored in the context of DRR is design probes. Design probes are tools designed to initiate critical thinking and elicit responses from participants. While they have been applied in many different contexts with various goals and objectives, (Mattelmäki, 2006a), they are gaining traction as an effective means to involve children in decision-making processes regarding various complex and bigger-scale problems such as sustainability (Matos et al., 2022), energy emission (Samso et al., 2017a), and education (Hayama & Desai, 2022). Characterised by their engaging and interactive nature, design probes can draw out authentic feedback and insights from children, thus enhancing and adding value to DRR efforts.

Reflecting on New Zealand's extensive history with various disasters, the relevance of DRR efforts is undeniable (Johnston et al., 2012). For instance, the 2011 Christchurch earthquake caused 185 deaths and widespread destruction, highlighting the ongoing seismic risks the country faces (Cubrinovski et al., 2011). More recently, the 2023 Auckland floods led to record-breaking rainfall and significant damage, underscoring the increasing frequency of extreme weather events (Ericksen, 2024). Additionally, the 2019 Whakaari/White Island volcanic eruption resulted in 22 fatalities, emphasising the persistent volcanic hazards in the region (Kilgour et al., 2021). These events illustrate the critical need for effective DRR strategies across New Zealand.

In the context of Tāmaki Makaurau / Auckland, a city celebrated for its cultural diversity and geographical distinctions (Cameron & Poot, 2019), there is a highly valuable window of opportunity to explore how design probes can contribute to children's involvement and engagement in DRR. Moreover, central to this research is the belief that children, when provided with the right tools, opportunities, and avenues, can transition from passive observers to proactive participants in disaster readiness and community resilience (Ronan & Johnston,

2005). Through a combination of design-focused approaches and DRR, this research aims to contribute to the redefinition of the narrative, acknowledging children as active agents of change. Figure 1 illustrates the primary themes of this research project as well as the common ground across these themes.

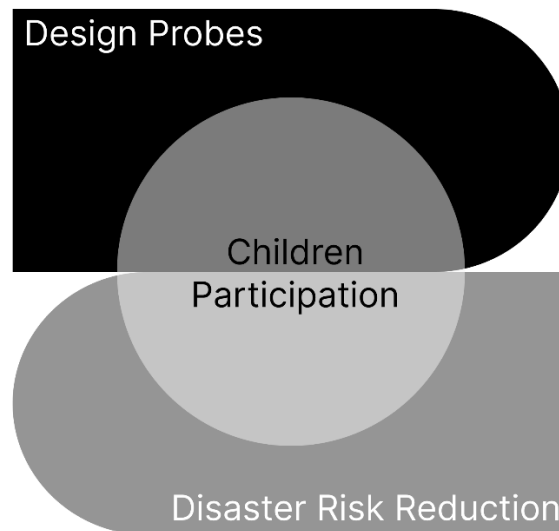


Figure 1. Thematic pillars of the study and where they meet

1.3. RESEARCH PROBLEM AND RESEARCH QUESTIONS

Within the interdisciplinary nexus of design and DRR, a pronounced research gap has been identified: the untapped potential of using design probes in the context of DRR, particularly in engaging children. While the significance of children's perspectives in building resilient communities is increasingly recognised, traditional DRR approaches have often overlooked the creative and innovative contributions that children can offer (Mitchell et al., 2009). This oversight, which originated from children's physical and psychological vulnerabilities (Peek, 2008), not only undermines the potential to harness children's unique insights but also fails to empower them as crucial stakeholders in disaster preparedness and resilience efforts (Wisner, 2006). The core of this research problem lies in exploring how design probes, as a participatory design tool, can bridge this gap by facilitating meaningful engagement and capturing the imaginative contributions of children towards DRR. The study poses several

research questions, each aimed at uncovering different aspects of how design probes can help facilitate the inclusion of children in DRR:

Research Question 1 – How can design probes be utilised to promote children's active and creative participation in disaster risk reduction?

This question investigates the unique attributes of design probes that can unlock the creative potential and active engagement of children in DRR. It explores how these tools can be designed and implemented to not only capture children's imagination but also facilitate their understanding of complex disaster risk concepts. The inquiry focuses on identifying the characteristics of design probes that encourage children to express their ideas, fears, and solutions in a manner that is both reflective and constructive. This includes assessing the role of narrative, gamification, and sensory elements in making the process of learning about and contributing to DRR both accessible and captivating for the younger audience.

Research Question 2 – How should a set of design probes be crafted to suit the context of DRR and to foster meaningful participation among children?

This question delves into the methodological considerations and creative processes involved in designing design probes specifically for children's participation in DRR. It aims to uncover the principles and practices that underpin the development of probes that are not only age-appropriate and engaging but also capable of eliciting deep insights and innovative ideas from children regarding disaster preparedness. This involves exploring aspects such as the thematic focus of the probes, the balance between structure and flexibility, the incorporation of educational and playful elements, and the ethical considerations unique to working with children. By examining these dimensions, the study seeks to establish guidelines for creating design probes that are effective in bridging the gap between children's experiential world and the adult-oriented domain of DRR.

Research Question 3 – In what ways do playful activities, as part of the design probes, enhance children's understanding and engagement in disaster preparedness?

This question seeks to articulate the specific mechanisms by which playful elements embedded in design probes can enhance the cognitive and emotional engagement of children with DRR. It examines the impact of incorporating play and interactive activities on children's ability to grasp disaster-related concepts, recognise risks, and conceptualise preparedness strategies. The exploration includes understanding how such activities can foster a sense of empowerment, collaboration, and critical thinking among children. Moreover, it considers the potential of playful learning to make DRR education more inclusive by catering to diverse learning styles and making complex information more digestible for young learners.

Research Question 4 – What are the outcomes of applying design probes in terms of building resilience and preparedness in children?

This question aims to evaluate the concrete outcomes of using design probes to empower children within the context of DRR, with a focus on measuring shifts in resilience and preparedness at the individual, household, and broader community levels. It considers the extent to which children, through their engagement with design probes, develop a deeper understanding of disaster risks and preparedness actions and how this understanding translates into practical measures and behavioural changes. Additionally, the question explores the ripple effects of empowering children as change agents: how their newfound knowledge and attitudes towards DRR can influence their families, schools, and communities, potentially leading to a culture of preparedness that permeates beyond the individual to effect systemic change.

1.4. AIMS AND OBJECTIVES

As an effort towards the use of creative methods to involve children in DRR, the primary aim of this research is to enhance and better understand children's

active and meaningful participation in the contexts of disasters, disaster risks, and disaster preparedness, with a particular focus on strengthening their sense of agency and positioning them as agents of change in DRR. In doing so, the study contributes to child-centred Disaster Risk Reduction by evidencing how participatory, creative approaches can support children's roles in preparedness, and to design research by extending the use of design probes as tools for engaging children with complex social issues. This study pursues this aim by using participatory, design-led probes as creative tools to explore how children can be more effectively engaged in DRR. To achieve this aim, the following objectives have been established.

Objective 1 – Investigating How Design Probes Contribute to Enhancing Children's Resilience and Participation in DRR (O1): This objective focuses on understanding how design probes can contribute to the current challenges and oversights, such as children's limited participation in DRR activities. Through the analysis of children's responses to the probe activities as well as the pre/post semi-structured interviews, the study examines how design probes can enhance children's resilience and participation in DRR. This objective is informed by references to the importance of involving children in DRR throughout the literature (Mitchell et al., 2009; Peek, 2008a; Towers et al., 2014). It is also informed by examples of applying a range of innovative and creative methods to involve children in DRR, from storytelling and creative arts (Drolet et al., 2018; Mort et al., n.d.; Pickering et al., 2022) to games and interactive activities (A. V. Gampell et al., 2017; Le Dé et al., 2021; Mossoux et al., 2016).

Objective 2 – Assessing the Designed Probes in Terms of Effectiveness and Engagement Through Visual Appeal and Overall Design (O2): The study aims to evaluate the user-friendliness and motivational appeal of the design probes. The effectiveness of the probes in enhancing children's understanding of disasters and motivation to learn more within this context is measured through post-activity interviews, drawing on research by Towers (2016), [Click or tap here](#)

to enter text. which highlights the key role of child-friendly disaster education tools.

Objective 3 – Exploring How Probe Kit Improve Children’s Understanding and Awareness of Disasters and Disaster Risks by Comparing the Pre/Post Interaction Interviews (O3): This objective seeks to explore the transformative impact of design probes on children’s awareness and understanding of disasters. The comparison of answers provided by participants from the pre/post interaction interviews will assess how the probe kits improve children’s disaster preparedness and awareness, paralleling research by Ronan et al. (2010). on educational strategies in DRR for children.

Objective 4 – Understanding Children’s Perspectives on Integration of Design Probes in DRR Context and Acknowledging Them as Proactive Agents of Change (O4): The goal is to gain insights into the application of design probes in DRR activities from participants’ perspectives, evaluating the benefits, challenges and recommendations. This will highlight how design probes can empower children, aligned with the findings of Anderson (2005) on the active role of children in disaster contexts.

These objectives collectively aim to address the research gap in children’s involvement in DRR, emphasising the importance of their role, recognising their untapped potential to contribute to DRR, and acknowledging them as active agents of change in the face of disasters. Building upon these objectives, a set of propositions has been developed. These propositions serve as hypotheses derived from the objectives, positing potential outcomes and impacts of the research. These propositions are instrumental in shaping the study’s direction and focus, ensuring a targeted approach towards the important role design probes can play in DRR contexts. Following the outlined objectives, this research puts forward the following propositions:

Proposition 1 (Drawn from Objective 1): Despite efforts to involve children in DRR, they currently remain underrepresented in this area. This study argues that design probes have the potential to significantly enhance children's engagement, involvement, and meaningful participation in DRR. This hypothesis is supported by the findings of Peek (2008), who underscores the importance of involving children in DRR activities.

Proposition 2 (Drawn from Objective 2): The role of children in strengthening disaster resilience is crucial yet often undervalued. This study aims to explore the impact of well-designed educational interventions on children's involvement in DRR. Blythe et al. (2004) and Mayer (2009) emphasise that effective design in educational tools can significantly improve user engagement and learning outcomes, suggesting that superior design and visual appeal in design probes will enhance children's motivation in DRR activities.

Proposition 3 (Drawn from Objective 3): This research suggests that activating children's agency can greatly contribute to DRR. It hypothesises that design probes, by sparking curiosity, can lead to a better understanding of disasters among children. Engel (2011) highlights the importance of engagement and curiosity in children's learning processes, indicating that design probes could serve as catalysts for children's imaginative exploration in DRR.

Proposition 4 (Drawn from Objective 4): Recognising children as proactive agents in disaster scenarios, this study explores the integration of design probes in DRR activities from participants' perspectives. Anderson (2010) emphasises the growing recognition of children as active contributors in disaster contexts, suggesting that insights from this study will highlight how design probes can empower children to understand and engage in disaster resilience.

1.5. THESIS STRUCTURE

This thesis is structured into eight chapters, each building on the next to explore how design probes can engage children as active participants in DRR. It begins by setting the stage for the research, then moves through an exploration of existing literature, methodological decisions, and key findings before reflecting on the broader implications and future possibilities.

The journey starts with Chapter 1, which introduces the study, outlining its objectives and the importance of recognising children as active contributors to DRR. It highlights the role of design probes as a participatory tool, setting the foundation for the research. This discussion deepens in Chapter 2, which reviews existing literature on DRR, child participation, and design probes. By examining previous research, this chapter identifies gaps and positions this study within a broader academic and practical context.

To explore these ideas in depth, Chapter 3 explains the study's methodology, detailing how participants were selected, how the probes were developed, and the techniques used to collect and analyse data. This is followed by Chapter 4, which tells the story of the iterative evolution of the probe kit and how it was designed, tested, and refined based on participant feedback. This chapter captures the hands-on process of improving the probes to make them more engaging and meaningful for children.

The findings of this research unfold across two key chapters. Chapter 5 presents a thematic analysis, exploring how key themes emerged from the data and what they reveal about children's engagement with DRR. Then, Chapter 6 builds on these findings with a comparative analysis, drawing insights from pre- and post-test interviews, sentiment analysis, and key takeaways. By looking at how children's understanding evolved throughout the study and their interactions

with the probes, this chapter then showcases deeper patterns in their learning and engagement.

Chapter 7 brings everything together, discussing how the research findings answer the study's core questions and what they mean for policy and practice. It considers how participatory approaches can be embedded in DRR education and reflects on the study's limitations while suggesting directions for future research. Finally, Chapter 8 wraps up the thesis, offering a final reflection on the research's contributions. It reinforces the central argument that children should increasingly be seen as active participants in DRR and highlights the potential of design-driven methods to make disaster preparedness more engaging, accessible, and meaningful for them.

At its heart, this research challenges the traditional view of DRR education and initiatives, which often treat children as passive recipients of information. Instead, it argues for a more creative, hands-on approach, one that values children's curiosity, imagination, and lived experiences. By using design probes, this study shows how children can engage with disaster preparedness in ways that feel authentic and empowering, encouraging them to think critically and take an active role in strengthening resilience within their communities.

1.6. CHAPTER SUMMARY


The introduction sets the stage for exploring how design thinking and DRR intersect through the lens of child engagement. It introduces design probes as a unique methodological tool, one that goes beyond traditional research instruments by tapping into children's creativity and imagination to meaningfully contribute to DRR. This approach challenges the common perception of children as merely vulnerable members of society, instead recognising them as insightful and innovative problem-solvers with ideas that can enhance disaster preparedness and resilience. By embracing the open-ended and flexible nature

of design probes, this research aims to provide a platform where children's voices are not just heard but actively shape and inspire DRR efforts.

The motivation behind this study stems from a recognition of the often-overlooked role of children in DRR. While conventional approaches tend to position them as passive recipients of disaster education, this research adopts a different stance that prioritises participation over instruction. Rather than relying on didactic methods, it investigates how participatory and creative approaches, through playful, reflective, and exploratory activities, can harness children's curiosity and imagination, enabling them to engage more deeply with complex preparedness questions in ways that are grounded in their own lives, households, and communities.

Building on this foundation, the chapter discusses the urgency and importance of involving children in DRR, especially considering the increasing disaster risks. It highlights a much-needed shift in perspective, one that acknowledges children as active agents of change, capable of offering unique insights and solutions. This shift is supported by a critical look at traditional DRR strategies and an exploration of how participatory design methods, such as design probes, can create more meaningful and engaging ways for children to contribute.

Through this lens, the chapter lays out the core research questions that drive the study, investigating the effectiveness, implementation, and impact of design probes in engaging children in disaster preparedness. By doing so, it builds a foundation for the rest of the thesis, articulating its objectives and positioning children not just as participants, but as empowered contributors to disaster resilience and preparedness.



*“Every individual matters.
Every individual has a role to play.
Every individual makes a difference...”*

– Jane Goodall

2008; Ronan & Johnston, 2005), which also brings attention to the overlooked potential and abilities children hold in this context.

The current literature review examines two key areas extensively. Firstly, it looks at how creative design methods, especially design probes are used in various situations towards tackling wicked problems such as disasters, sustainability, energy emissions, etc. Design probes are tools known for drawing out insightful responses and ideas while inspiring participants towards certain behaviours, critical thinking, and reflection (Graham et al., 2007b). The review explores their effectiveness in different scenarios across various age groups, considering how these tools, used in a variety of fields, can be adapted for disaster challenges involving children. Secondly, the review focuses on involving children in DRR, moving beyond viewing children as mere victims and arriving at the investigation of various ways to actively engage children in DRR. The aim has been to explore previous studies that shine light on addressing children's needs in the face of disasters, as well as empowering them to contribute to disaster preparedness and risk reduction. Building on these two areas, the review also examines the intersections and opportunities that arise highlights new possibilities for fostering meaningful engagement. This from integrating these fields. By combining the use of creative design tools, such as probes, with approaches that actively involve children in DRR, this integration includes creating participatory methods that leverage children's creativity, agency, and unique perspectives to strengthen disaster preparedness efforts. This exploration also includes an examination of other innovative approaches like gamification and storytelling, which have shown potential in improving engagement and learning experiences in participatory activities(Blythe et al., 2004; Robertson, 2012).

This review also contrasts top-down and bottom-up approaches to DRR participation and clarifies how the study positions children within established participation frameworks (e.g., Arnstein; Hart). These lenses are later used to interpret the empirical results, connecting children's creative outputs from design probes to specific degrees of participation and power-sharing.

2.2. DESIGN PROBES

Design probes is a method created to develop an understanding of a setting or situation. (Mattelmäki, 2006a; E. B. N. Sanders & Stappers, 2014) The purpose of probes is not to merely capture *what is*, but is to inspire *what could be*. Their aim is to make way for possibilities rather than finding or revealing truths. Through cultural probes, the designers intend to comprehend people's instinctive playfulness and mindfulness in the designs that would eventually be proposed (Boehner et al., 2012a). It is important to consider the fact that probes are not only a way to gather inspirational insights on the target group, but they also intend to inspire the group towards certain behaviours as well. Probes have also been described as collections of evocative tasks and activities designed with the intention of eliciting inspirational responses from people (Graham, 2008).

Cultural Probes as originally presented by (Gaver et al., 1999), were essentially aesthetic packages with which included multiple items with different activities and interactions for participants to complete and send back to the designers over a certain period of time. These tasks and activities are usually designed with the intent of exploring the participant's viewpoints, habits, wishes, or even fears. To capture or to extract this information, the tasks and activities vary from using diary, photography, or question cards all the way to more innovative and technologically enhanced tasks such as digital diaries, voice or video recordings (Graham et al., 2007b; Wyche, 2019). Figures 2 and 3 illustrate an example of a cultural probe pack and some of the completed probes which were returned to the researchers, respectively. The items consisted of disposable cameras, postcards, and maps. to gather inspiration from the target group and to gain meaningful insights regarding their preferences, interests, hopes, and fears in order for the designers to come up with designs that would be well-received and relevant (Gaver et al., 1999b). It is important to note that when using probes, the focus is on inspiration rather than information (Graham et al., 2007b; Mattelmäki, 2005a; Megens et al., 2013a). Cultural probes were created to prevent designers from playing the role of 'doctors', diagnosing user problems or the role of

servants, letting the target group set directions for the designs. Some key aspects of cultural probes are that they are playful and aesthetically pleasing by design, and they should be designed to have an inviting appearance to engage their audience (Behbahani et al., 2019a; Boehner et al., 2012a; DiSalvo & Roshan, 2014a; Mattelmäki, 2006b).



Figure 2. A cultural probe package (Gaver et al., 1999b)



Figure 3. Some of the returned items (Gaver et al., 1999b)

Since the introduction of design probes, they have been used in various contexts with various intentions such as sustainability (Megens et al., 2013b), technology use and adaptation (Hagen, 2006; Hulkko et al., 2004a; Wherton et al., 2012), game development (Gennari, Melonio, Raccanello, et al., 2017; Lange-Nielsen et al., 2012) energy emission and energy awareness (Samso et al., 2017b; Tellols et al., 2016a), education and learning (Azambuja et al., 2015; Gennari, Melonio, & Torello, 2017). Hulkko et al. (Hulkko et al., 2004a) have applied design probes for two case studies to explore and study people's actions in mobile contexts. Furthermore, Wherton et al. (Wherton et al., 2012) developed cultural probes to explore how assisted-living technologies are used by the elderly in their daily

lives. They also suggest that cultural probes can help build a rich picture of people's lives and experiences to facilitate the co-production of assisted living technologies. Lange-Nielsen et al. (Lange-Nielsen et al., 2012) have applied cultural probes to generate games as a user-centred methodology with game-related content. They aimed to gain insights into what game elements would interest their participants. They bring attention to the point that probes approach can be applied to evoke situated responses from the participants which can serve as strong points of focus for the development of game mechanics and themes.

Samso et al. (2017) proposed a gamified design of cultural probes in an application of smart droids aiming to enhance the participation of children who developed tasks to provide information about habits of energy consumption. Tellols et al. (Tellols et al., 2016a) developed a gamified energy awareness cultural probe utilising artefact and tasks for children to gain information designers about energy use and energy consciousness considering participants and their families. Azambuja et al. (Azambuja et al., 2015) have collected data and inspiration using cultural probes to develop a proposal for an Internet Protocol Television (IPTV) education interface for distance learning. Rosella Gennari (Gennari, Melonio, & Torello, 2017) has developed a tangible gamified probes for promoting a sense of progression and control as well as social relations in a cooperative learning process in a classroom environment.

On the other hand, evidence from the literature shows various research studies have developed alternations and extensions of the original probe tool to suit different intentions and goals of these studies. Examples of these modified probes include empathy probes (Mattelmäki & Battarbee, 2002a), technology probes (Hutchinson et al., 2003), digital probes (Koch & Maaß, 2018a), mobile probes (Blomhøj & Duvaa, 2011), medium probes (DiSalvo & Roshan, 2014a), urban probes (Paulos & Jenkins, 2005a), multisensory probes and sensory probes (Behbahani et al., 2019a; Gayler et al., 2021a), value probes (Vaida &

Mynatt, 2005), identity probes (F. J. Candy, 2003), informational probes (Crabtree et al., 2003), and memory probes (Tsai & Hoven, 2018a).

Mattelmäki & Battarbee (2002) suggest when moving from rational and practical issues to private contexts and personal experiences, design empathy is needed. They combined the probe approach with interviews and projective tasks to gain a holistic and empathic understanding of the participants. Hutchinson et al.(2003) proposed technology probes as flexible and adaptable technologies with certain goals. The interdisciplinary goals of this specific type of probe include: The goal of understanding the needs and desires of users in a real-world setting, the goal of field testing, and the goal of inspiring the users and researchers regarding future technology developments. Koch & Maaß(2018) developed a digital probe through the use of smartphones, which would allow for documentation of everyday life and provide a permanent channel for communication between the researchers and participants.

DiSalvo & Roshan (DiSalvo & Roshan, 2014a) proposed medium probes to address the goal of engaging the community with discussions of information medium. The main goal of this study and probe design was to bring attention and focus to the very experience of using multiple mediums to respond to prompts, rather than the responses themselves. The name 'medium probes' was chosen to both reflect a focus on learning about design choices leading to information mediums, and to indicate a middle space between the open-ended nature of cultural probes and the set goals of technology probes. Paulos & Jenkins (Paulos & Jenkins, 2005a) presented urban probes with the intention of initiating inspirational research into the very essence of newly emerging technological urban spaces. They aimed to further explore and develop a better understanding of the emotional experiences of urban life. Multisensory design probes were introduced by Behbahani et al. (Behbahani et al., 2019a) are a tool for individuals to reflect on their relationship with technology. The multisensory probes emphasise slowness by having participants switch from one sense to another

though a series of playful activities. It also aims to reduce tension and stress. In a somewhat similar study, Gayler et al., (Gayler et al., 2021a) presented another innovative modification to probes called sensory probes which aim at exploring human-food interaction through multisensory experiences.

Due to the customisable nature of probes and the fact that they have been utilised and applied in different setting across various disciplines, they can also be categorised in terms of different age groups they are aimed at, from young children (Azmi & Abdul Razak, 2015a; Gennari et al., 2016; Rodríguez et al., 2020a) to teenagers (Mattelmäki et al., 2016b), to adults (Paay et al., 2018) and to older adults and the elderly (Caleb-Solly et al., 2011; Gaver et al., 1999b; Jarke & Gerhard, 2017a, 2018). There are even some research studies that have used the probes method to study families (Dalsgaard et al., 2006a) and even intergenerational relationships between the participants (Mayasari et al., 2016; Pedell et al., 2014). These studies demonstrated that design probes can effectively elicit rich qualitative data that reveal deep insights into family dynamics and the nuanced interactions across generations. For example, Dalsgaard et al. (2006) found that probes helped uncover underlying emotional connections and communication patterns within families, while Mayasari et al. (2016) and Pedell et al. (2014) highlighted how probes facilitated a better understanding of the values and expectations that different generations hold.

Rodríguez et al.(2020a) proposed digital cultural probes in the context of energy awareness, specifically aimed at children. Based on the findings, they suggest a lower number of tasks in a probe is more likely to achieve a high completion rate. Mattelmäki et al. (2016) developed a probe specifically made for teenagers and suggested due to the age group, the aesthetics and usability of the probes required further attention in the design process. Paay et al.(Paay et al., 2018) designed digital probes specifically suited for adults who struggle with self-esteem. Many other studies, including Bill Gaver's introduction of probes (Gaver et al., 1999b), came up with probes to explore the daily lives of an unknown

group of elderly as well as their wishes, desires, and fears in order to build relevant and well-accepted designs. Dalsgaard et al. (Dalsgaard et al., 2006a) designed probes not for merely one specific age group, but for families. They aimed to explore and unfold relationships between parents and their children with the goal of designing technologies for mediated intimacy in families. In another work, Mayasari et al. (Mayasari et al., 2016) came up with modified probes to investigate affective intergenerational communications over distance, specifically between grandparents and their grandchildren. Table 1 provides a breakdown of probe study examples showcasing how they have been applied across diverse contexts and demographics.

Table 1. Examples of probe applications across different contexts.

Paper Title	Target Demographic	Approach/Implementation	Context/Domain	Reference
Cultural Probes	Elderly participants in three diverse communities (Oslo, Bijlmer, Peccioli)	Packages containing maps, postcards, cameras, and booklets were distributed to gather "impressionistic" insights about participants' lives, attitudes, and environments. These probes encouraged reflection and creative responses through tasks like marking maps, taking photos, and writing postcards. The approach emphasised aesthetic and playful interactions.	Exploring novel interaction techniques to enhance elderly engagement in their local communities.	(Gaver et al., 1999a)
Empathy Probes	Individuals aged 24–71 who exercise for health and well-being (non-users of heart rate monitors)	Probes included diaries with stickers, disposable cameras for photography tasks, and illustrated cards with open-ended questions. Participants recorded daily routines, feelings, and visualised ideal well-being through collages. Data was supplemented with personal interviews and workshops to deepen understanding and foster empathic connections.	Understanding motivations, emotions, and experiences of people who exercise for health and well-being.	(Mattelmäki & Battarbee, 2002b)
Technology probes: Inspiring design for and with families	Families, school communities, and individuals in their domestic and educational environments	Technology probes were simple, adaptable devices designed with three goals: understanding user needs and desires in real-world settings, testing new technologies, and inspiring users and researchers. These probes were deployed in natural settings (homes, classrooms) with tools to record interactions and gather insights for the design of new technologies.	Exploring how users engage with technology in everyday settings, including homes and schools, for design inspiration.	(Koch & Maaß, 2018b)
Digital Probes Kit	Participants with digital literacy, including young IT professionals, working couples, and senior citizens	Digital Probes use smartphones for self-documentation, allowing in situ recording via text, photos, GPS, video, and audio. Participants engage with a digital diary-like tool for documenting everyday activities, with continuous communication between participants and researchers for feedback, clarification, and nudges.	Human-computer interaction (HCI), software design, and ethnographic research for requirements elicitation.	
Medium probes: Exploring the medium not the message	Parents in economically depressed communities, particularly African-American mothers	Medium Probes involve multiple communication tools (e.g., paper journals, disposable cameras, social media like Twitter and Tumblr) to elicit responses to prompts. Participants experiment with diverse media, enabling discussions on the role and impact of different information mediums.	Human-computer interaction (HCI), technology access, and information design, particularly in underserved communities.	(DiSalvo & Roshan, 2014b)

Urban Probes: Encountering our emerging Urban atmospheres	Urban populations, focusing on city inhabitants and the dynamics of public spaces	Urban Probes use provocative, lightweight, and experimental methods to explore urban computing's potential impact on public urban spaces. Methods include deep observations ("body storming"), interventions like the "Lost Postcard Technique," and interactive artifacts such as augmented trashcans. These approaches aim to inspire discussions, highlight patterns, and reveal opportunities for technology in urban landscapes.	Urban computing, public spaces, and city life exploration.	(Paulos & Jenkins, 2005b)
A multisensory design probe: An approach for reducing technostress	Individuals experiencing technostress, including general technology users	The study introduces a multisensory design probe aimed at reducing technostress and fostering reflection through slow, tangible, and multisensory interactions. The probe consists of a five-step activity kit designed to explore the concepts of slow technology and multisensory interaction. Activities include sculpting with clay (creativity and touch), using an interactive "Thought Box" for verbal journaling, an "Aroma Box" for olfactory exploration, and an interactive pillow with calming music. These activities aim to promote stress reduction, encourage pauses for reflection, and investigate how technology can become a tool for mindfulness rather than a stressor.	Human-Computer Interaction (HCI), stress management, critical design, and slow technology	(Behbahani et al., 2019b)
Sensory Probes: An Exploratory Design Research Method for Human-Food Interaction	General participants interested in food experiences, including younger and older adults	This study introduces Sensory Probes, a novel design research method tailored to explore and sensitise participants to the multisensory, emotional, social, and bodily aspects of food experiences. The probe kit includes activities such as a TasteWho gameboard (pairing flavour descriptors with abstract visuals), writing recipes as letters (exploring emotions or memories), sensory augmentation tools (e.g., nose clips, earplugs, blindfolds), a body mapping booklet (tracking digestion), and diary tools for capturing contextual food environments. Probes were co-designed in workshops and iteratively refined in two-week diary studies with 18 participants, yielding insights into sensory fragments, interoceptive awareness, and emotional narratives around food.	Human-Food Interaction (HFI), multisensory design, and exploratory methods in HCI	(Gayler et al., 2021b)

From cultural probes tasks to gamified virtual energy missions	Children aged 8–12 years and their families	The study introduces gamified Cultural Probes (CP) for understanding family energy habits and fostering awareness of energy consumption. A mobile app engages children in a narrative where they complete missions (e.g., as a psychologist, detective, electrician, or journalist) to gather data and earn rewards. Gamification elements include avatars, badges, leaderboards, and real prizes, designed using the Gamification Model Canvas (GMC) framework.	Smart Grid and family energy habits	(Samso et al., 2017a)
Mediated Intimacy in Families: Understanding the Relation between Children and Parents	Families with children aged 6–10 from three households in Denmark.	Cultural Probes: Provided families with scrapbooks, disposable cameras, diaries, postcards, and other creative tools to document their interactions and aimed to investigate mediated intimacy in families, focusing on how technologies could support parent-child relationships and enhance shared interactions. Contextual Interviews: Conducted three meetings to introduce, clarify, and discuss findings related to intimacy dynamics. - Data analysis used grounded theory to identify themes and compare parent-child intimacy with strong-tie intimacy.	Parent-Child and cross-family relationships.	(Dalsgaard et al., 2006b)

Other alternations to design probes are not limited to the developments and applications. The literature even shows different approaches to probes at different stages, from ideation and creation to analysis. As an example, in a study by (Moser et al., 2011), came up with a modified probes approach to collect data. Their approach involved children not only as participants of the probes study, but also as active agents in the development and deployment of the probe's materials. In another study a variation of cultural probing called playful probing was introduced (Bernhaupt et al., 2007a). Playful probing was developed with the intention of increasing participants' engagement. It is suggested that by bringing an element of playfulness, there can be a significant increase in the number of insights, information and inspiration gathered from a probe study (Bernhaupt et al., 2007b).

Although many studies have analysed applications and developments of design probes in various fields, the question of effectiveness of such interventional design and research tools, satisfying the intention of utilising this tool to suit different purposes, remains unanswered. There are multiple studies that have viewed and inspected probes and their variations from different lenses. For instance, (Derix & Leong, 2019a) suggested there is not much reflection and discussion regarding the thinking behind the creation and use of probes and actionable guidance on designing and using probes is lacking. Through reviewing the literature on probes, they have suggested a framework to classify and help future designers and researchers design their probes based on the following design properties: openness and boundness, pace, and challenge. Based on the suggested framework, by exploring these properties, we can have different types of results, from icebreaker probes to probes for deeper reflection. In other words, more boundedness, faster pace and lower challenge bring the probe design on the more ice breaker side, while more openness, slower pace, and higher challenge bring the opportunity for deeper exploration and reflection.

(Mattelmäki et al., 2016b) suggested looking at probing as a tool from two different perspectives: As a process of collaborative discovery and learning and as a tool for entering the users' contexts. In this work, they have further illustrated through case studies in which probes were introduced in educational and professional environments. It is further elaborated that probes, as a self-documentation method, need to communicate, inspire, and engage the participants on their own, going beyond the control of designers and researchers. In terms of entering the users' context, most published probe studies have been carried out in domestic contexts. That is, while there are cases in which probes have been experimented on to explore work contexts which suggests that applying the probe approach at work has specific characteristics which have not been addressed formally. Therefore, considerations should be taken to engage the users in the probing process in professional environments (Mattelmäki et al., 2016b). In another study, (Çerçi et al., 2021) explore different interpretations of probes and argue that designers and researchers interpret probes differently based on multiple aspects such as conceptual framing, epistemological roots, and methodological diversity. This means how probes are defined and understood within the specific context of a project highly influences their use. This includes how researchers conceive probes in relation to their theoretical and methodological backgrounds.

There are numerous possibilities and opportunities for using probes, combining it with other methods, or even further developing and applying the probes in various settings and scenarios. As an example, (Mattelmäki, 2005b) drew attention to the lack of motivation in participants to complete the probe tasks as a challenge. (Jarke & Gerhard, 2017a) faced the challenge of the probe tasks and activities coming off as too demanding in terms of time and energy. Although there have been suggestions and solutions for such challenges, they do still exist and can be solved more efficiently through more creative and innovative actions and solutions. Moreover, one way of addressing the mentioned challenges with

probes in previous studies is to include the element of gamification in the design process and the items and activities that come in the probes.

Probes are extractive by nature and have primarily been used to help designers in the design process by gathering inspiration and information about the target audience. Nevertheless, due to the creativity and playfulness of design probes, they can introduce even more opportunities to explore (Graham et al., 2007b). As an example, participation and design probes and their inner relationships have not been explored. In participatory terms, design probes typically operationalise a bottom-up stance (Jarke & Maass, 2018). They elicit participants' situated knowledge and invite co-creation through expressive artefacts. At the same time, probes are scaffolded by researcher-defined prompts and materials, which introduce light top-down structure to focus engagement (Derix & Leong, 2019b). This hybrid character matters for the present study. The probes were designed to maximise children's agency and voice, while retaining minimal guidance to keep tasks accessible and age-appropriate.

One area in which cultural probes have not been used is Disaster Risk Reduction (DRR). The creative nature of probes brings out opportunities to tackle challenges and problems of involving participants in DRR, which is highly important and timely in today's world. It can be a novel way of involving participants in the design process of finding solutions to challenges of building resilience and awareness around disasters.

2.3. DISASTER RISK REDUCTION (DRR) PRINCIPLES AND PRACTICES

Disaster Risk Reduction (DRR) encompasses a broad range of practices aimed at minimising the damages and losses caused by disasters. It is a multidisciplinary field that integrates strategies from various domains to enhance the resilience of individuals, communities, and nations in the face of hazards and disasters. Resilience in DRR refers to the capacity of individuals, communities,

and systems to anticipate, adapt to, and recover from the effects of a disaster in a timely and efficient manner (Cutter et al., 2010). This concept, central to DRR, involves not just surviving disasters but also maintaining capacity during and after disasters (Manyena, 2006). DRR integrates multiple critical principles such as risk assessment, community participation, and resilience building, each of which is an essential contributing factor to disaster management and risk reduction. Central to these DRR principles, is understanding disasters, which are broadly defined as severe disruptions causing human, material, economic, or environmental losses beyond the coping capabilities of the affected community (Wannous & Velasquez, 2017). This perspective emphasises that disasters, involving both natural and human-made hazards, require a multifaceted response approach.

2.3.1. DRR IN NEW ZEALAND

DRR in New Zealand is a critical area of focus, given the country's high exposure to natural hazards such as earthquakes and tsunamis. The geographic and geological setting of New Zealand places many of its communities, including children and adults, at risk of experiencing these disasters (King et al., 2013). The country's history with significant disaster events, like the 2011 Christchurch earthquake and the 2023 cyclone Gabrielle, underscores the importance and the need for robust DRR strategies and efforts. Despite the inherent risks, there is a growing recognition of the ability of individuals and communities in Aotearoa, New Zealand, to effectively respond to disasters using their own resources. Paton et al. (2014) bring attention to the resilience of these communities, highlighting how local capacities and resources are pivotal in overcoming the challenges carried out by disasters.

Additionally, in the context of Auckland, New Zealand's most populated and culturally diverse city, the integration of various cultural perspectives in DRR is highly important. Auckland's rich tapestry of cultures brings diverse interpretations and coping mechanisms for natural hazards related disasters.

This multicultural context necessitates DRR strategies that are not only scientifically sound but also culturally sensitive and inclusive. Māori for instance, have a unique worldview regarding natural phenomena, attributing earthquakes to Rūaumoko (or Rūamoko), the god of earthquakes, in their mythology. This perspective, deeply rooted in Māori connections with the natural world, exemplifies the cultural dimensions of understanding and responding to disasters in New Zealand (King et al., 2013; Teara.govt.nz, 2021).

The challenges and opportunities in New Zealand's DRR lie in the union of these diverse cultural insights with modern scientific knowledge. Integrating traditional cultural knowledge and understanding, with contemporary and scientific approaches to disasters can offer a more holistic and culturally nuanced approach to disaster preparedness and response. This approach aligns with the broader goals of the New Zealand Civil Defence Emergency Management (CDEM) strategy, which is founded on principles of comprehensive risk management encompassing reduction, readiness, response, and recovery (Ministry of Civil Defence & Emergency Management (MCDEM), 2015). Aligning with international frameworks like the Sendai Framework, the CDEM strategy emphasises a deep understanding of disaster risk in all its dimensions, incorporating diverse cultural knowledge and experiences to enhance community resilience.

2.3.2. DRR AND PARTICIPATION

DRR is a systematic approach aims towards identifying, assessing and reducing the risks and vulnerabilities carried by disasters and unfolding the impacts throughout a society in the context of sustainable development. It is also considered as practice of reducing risks through systematic efforts to analyse and reduce the causal factors of disasters. DRR considers disasters as socio-economic and political issues (Wisner et al., 2004). Despite the previous views on disasters, which presented them as unavoidable natural events, contemporary approaches increasingly emphasise the broader social, political,

environmental, and economic contexts in which hazards occur. This shift acknowledges that proactive management of risk reduction plays a critical role in mitigating disaster impacts (Mercer, 2010).

This evolution in disaster studies reflects a significant paradigm shift from the hazard paradigm to the vulnerability paradigm. The hazard paradigm focuses on the natural or physical causes of disasters, such as earthquakes, floods, or hurricanes. It is rooted in the understanding that disasters are triggered by the magnitude and frequency of natural events, emphasising the immediacy and unpredictability of such hazards. However, this view is now considered overly simplistic as it overlooks the underlying societal and structural factors that contribute to disaster outcomes (C. Wisner & Nivaran, 2003).

The vulnerability paradigm, by contrast, shifts the focus to the social, economic, and political conditions that render communities susceptible to harm from hazards. These vulnerabilities include systemic issues like social inequality, poverty, inadequate urban planning, environmental degradation, and weak governance structures. By addressing these root causes, the vulnerability paradigm reframes disasters as socio-political phenomena rather than inevitable consequences of natural events. This approach not only highlights the role of vulnerabilities in exacerbating disaster impacts but also underscores the importance of reducing these vulnerabilities through targeted interventions and inclusive risk management (Kelman et al., 2016).

Disaster Risk Reduction (DRR) entails an all-of-society engagement and partnership. It also requires empowerment and inclusive, accessible, and unbiased participation, as well as bringing attention to the people who are more vulnerable to disasters. Participation in DRR is a multifaceted process increasingly acknowledged for its importance in addressing vulnerabilities and strengthening resilience. It involves collaboration among diverse stakeholders from various sectors and levels of governance (Cornwall, 2003a). This includes

not only involvement in the decision-making process but also the implementation of practical strategies that directly impact vulnerable populations. Special attention is needed for groups that are disproportionately affected by disasters, ensuring that these individuals are not only recipients of aid but also active agents in their own resilience building (J. C. Gaillard et al., 2018b).

Participation includes initiatives involving people in various issues that affect them directly. Youth participation varies across different groups. It requires efforts by young people to organise around issues of high importance and by adults to join together in intergenerational partnerships (Checkoway, 2011). The key issue is not whether the effort is led by youth, adults, or both generations together, but rather whether the effort makes an impact. There are several levels of participation, and various models and frameworks, such as the ladder of participation, have been developed to describe these levels, from tokenism to delegated control (Andrea Cornwall, 2003). In a study, Roger A. Hart (2008) presents a ladder of participation that is aimed specifically at children and younger people. This framework is an adaptation of Arnstein's ladder of participation (Arnstein, 1971). The levels from bottom to top include manipulation, decoration, tokenism, assigned but informed, consulted and informed, adult-initiated shared decisions with children, child-initiated and directed, and child-initiated shared decisions with adults, respectively.

2.3.3. CHILDREN AND YOUTH PARTICIPATION

Participation involves various diverse groups of people, such as academics, practitioners, communities, policymakers, children, and young people (Sinclair, 2004). In traditional approaches to decision-making, children have often been excluded or treated as passive recipients of policies and services, with adults retaining most of the power, knowledge, and decision-making authority. However, there is a growing recognition of the importance of moving beyond these hierarchical structures and embracing a more participatory model where children's views are actively sought and valued (Delicado et al., 2017; R. A. Hart,

2013). While the hope is that decision-making will increasingly become a partnership between children and adults, this shift raises important issues, such as how to present and interpret the views of children, and how to ensure their voices are meaningfully included rather than tokenistic.

Moreover, physical needs such as water, food, shelter, and primary healthcare for a child in disasters are essential but not enough (Martin, 2010). Children should be considered from a holistic point of view, meaning as worthwhile actors who have special needs but at the same time, have special capacities to produce helpful knowledge and actively contribute to disaster relief and recovery efforts. On the notion of participation in children, Peek (Peek, 2008b) has mentioned that the experiences of children in the event of a disaster should be carefully considered due to various reasons: they are among the most vulnerable groups, their recovery trajectories often differ from adults, and they possess valuable perspectives that can inform more effective and inclusive disaster management strategies. . It is also mentioned that children are primarily at risk during and after disasters, given that they are psychologically vulnerable and may develop post-traumatic stress disorder or related symptoms, and they are also physically vulnerable to injury, illness, and abuse (Peek, 2008a). Moreover, children, despite their vulnerability, have the potential and capacity to contribute to disaster preparedness as well as response and recovery activities.

Researchers are increasingly bringing attention to the significance of empowering children in the context of DRR (J. C. Gaillard et al., 2018a; Gibbs et al., 2013; Hore et al., 2018; Mudavanhu et al., 2015; Towers et al., 2014). Their research points to the vital role children can play in enriching our understanding of disaster experiences and calls for a shift toward more participatory DRR approaches. For example, Gaillard et al. (2018a) advocate for child-inclusive disaster governance, arguing that children should be recognised as legitimate stakeholders rather than passive recipients of aid. Their study highlights successful participatory methods, such as child-led risk mapping and youth-

driven preparedness initiatives, which foster resilience at the community level. Similarly, Towers et al. (Towers et al., 2014) examined child participation in Australian DRR education, demonstrating that involving children in school-based preparedness programmes enhances not only their individual understanding but also household and community resilience. Hore et al. (2018) further support this by analysing participatory video methods that empower children to document and communicate disaster risks, thereby amplifying their voices in decision-making processes. Overall, they advocate for acknowledging children's contributions to disaster management, emphasising the value of shared responsibility and the critical role of community contributions in disaster-related decision-making processes. This approach not only empowers children but also highlights the importance of integrating community perspectives to prioritise actions effectively in DRR strategies.

2.3.4. PARTICIPATION AND ENGAGEMENT THROUGH GAMIFICATION AND STORYTELLING

Within the DRR space, fostering deep engagement and participation, especially among younger demographics, is crucial for building resilient communities. This section delves into the application of gamification and storytelling as advanced pedagogical strategies to enrich children's involvement in DRR, presenting a nuanced exploration of their theoretical underpinnings, practical implementations, and the potential impact on enhancing children's learning experiences in the context of DRR.

2.3.5. APPLICATIONS OF PARTICIPATORY APPROACHES TOWARDS DRR

In disaster studies, many participatory methods have been used to help with disaster awareness and preparedness in various age groups. Van Manen et al., (Van Manen et al., 2015) mentioned that disaster preparedness at individual, household, and community levels is a key component of resilience in a disaster. They conducted participatory workshops to promote participant engagement in the process of developing ideas on enhancing the adaptation of self-protective

behaviours. The results and findings produced from the workshops revealed that the participant's key priorities centre around the well-being of their family members and friends. In another study conducted by Toyoda (2016), gaming simulation is used to deliver DRR training at a community level. In this study, the aim is to help participants gain knowledge on disaster preparedness through game simulations and the goal is that the participants would become capable of applying the knowledge they have gained in real-life events.

(Haynes & Tanner, 2015) used Participatory Video (PV) methods with groups of young people in three communities in Easter Samar and the Philippines. Using this method led to the production of videos, which enabled the groups to document and research disaster risks. A key benefit for the participants of this study was gaining knowledge and awareness of disaster risk not only at individual levels but also in their communities. Moreover, in this study, adults were surprised by the level of knowledge displayed by youth and their emphasis on the underlying social causes of disaster. Furthermore, after the occurrence of a disaster, there comes a great deal of physical and emotional damage to members of communities, and for years, architects, planners, and urban designers have been asked to participate in the rebuilding process (Donovan, 2013). In many cases, efforts in the recovery process have made things worse by overwhelming those in charge. Consequently, promoting participation at individual and community levels has been increasingly seen as central to DRR.

Although several studies and different works have examined youth participation in DRR, there is still room for further innovative approaches to involve children in DRR. It is also important to get past the challenges that have arisen from previous works, such as having difficulty with encouraging children to participate due to a lack of clarity as to what participation means, cultural resistance, lack of capacities, and lack of monitoring and evaluation tools (Muzenda-Mudavanhu, 2016b). Additionally, creative methods can be used

along with playful and gamified mechanics and approaches to both foster youth participation and increase the quality of participation.

2.4. THE ANGLE OF DESIGN PROBES: FROM TOP-DOWN TO BOTTOM-UP IN CONNECTING CHILDREN'S PARTICIPATION AND DRR

Top-down approaches in both realms of DRR and design are characterised by expert-led agenda setting, formal authority, and standardised communication; they can enable rapid coordination and consistency at scale but risk limited local ownership and contextual fit (Enenkel et al., 2017; Nkombi & Wentink, 2022). In contrast, bottom-up approaches foreground community agency, local knowledge, and co-creation, often improving relevance, learning, and legitimacy, while facing challenges of time, consistency, and scalability (Bromark et al., 2023; Mukerji et al., 2024). In participatory design with children, bottom-up methods seek to surface children's lived perspectives and empower contribution (Gottschalk & Borhan, 2023). Accordingly, this study explicitly pursues a bottom-up orientation and resists top-down determinism.

The intersection of design probes, child participation, and DRR represents a novel approach aimed at further contributing to disaster preparedness and resilience strategies by exploring new ways to foster children's participation, with a particular focus on adopting a design-led bottom-up approach within DRR. Consistent with this stance, bringing these areas together presents a unique chance to integrate children's creativity and insights into developing adaptive and resilient communities. By facilitating expression through artifacts and activities that resonate with their worldviews, design probes enable children to articulate complex understandings of concepts such as risk, safety, and community in accessible and meaningful ways. This inclusive approach shifts disaster management practices towards more participatory strategies, recognising the untapped potential of younger populations to influence positive change and challenging traditional paradigms that historically marginalised their voices (Mitchell et al., 2009).

Gaver, Dunne, and Pacenti's (1999) introduction of design probes into the participatory design landscape marked a significant shift towards employing more exploratory and empathic approaches to understanding user experiences and viewpoints. In the context of engaging children, design probes have the potential to serve not only as tools for elicitation but also as bridges connecting children's imaginative realms with tangible disaster resilience practices. By facilitating expression through artifacts and activities that resonate with their worldviews, design probes can enable children to articulate complex understandings of risk, safety, and community in accessible and meaningful ways (E. B. N. Sanders & Stappers, 2014).

The bridging role of design probes in connecting children with DRR initiatives highlights the transformative potential of this methodological tool. Engaging children through design probes facilitates a dialogical process in which children's creative outputs and expressions become a medium for communication and collaboration with adults and decision-makers. For instance, the use of storytelling and scenario-building activities enables children to project their understandings and solutions into real-world contexts. This approach not only initiates a more inclusive conversation on DRR but also sparks innovation by integrating varied and frequently underestimated viewpoints into the planning and execution of DRR strategies.

The theoretical underpinnings supporting the integration of design probes in DRR with a focus on children's participation are drawn from a rich tapestry of participatory design, child development, and resilience theory. Participatory design principles advocate for users to be seen as co-creators in the design process regardless of age. This belief aligns with the principles of child-centred research and design, which emphasises acknowledging children's rights and capabilities as introduced in the UNCRC (Lansdown et al., 2005). Theories of resilience and agency further support this approach, suggesting that empowering individuals, including children, to participate in decisions that affect

their lives foster resilience not just at the individual level but across communities and systems (Ungar, 2011). This theoretical framework positions children's participation through design probes not as a mere methodological preference but as a strategic approach to spark inspiration for building societal resilience from the ground up.

Delving deeper into the implications of this intersection reveals a dual pathway towards enhancing both the theoretical understanding and practical application of DRR. Academically, bringing the areas of design probes, child participation, and DRR together challenges existing paradigms, advocating for a more inclusive, participatory foundation for research and practice. It calls for a re-evaluation of how children's capacities and creative expressions can be integrated into DRR. Practically, this methodology offers a blueprint for developing DRR initiatives that are more reflective of community diversity, more adaptable and sustainable, and better catered to children, allowing for a deeper exploration of their perspectives and fostering a culture of preparedness that transcends generational boundaries.

2.4.1. PARTICIPATION AND EDUCATION IN DESIGN AND DRR

An important distinction in this research is the interplay between the terms participation and education which take on slightly different meanings in design research and in DRR. In design research, participation typically refers to participants contributing to the design process in varying shapes and forms where their insights and feedback help shape the iterative development of the designs in different contexts (Andersen et al., 2015; Lee, 2008). This approach to participation in design research can vary significantly. In many cases, participation is user-centred and refers to participants contributing feedback and insights that inform iterative design processes without having full decision-making power or control over the outcomes (Sanders & Stappers, 2008; Spinuzzi, 2005). In this context, participants are collaborators whose input helps shape the research or design, but they are not co-creators in the fullest sense.

However, participation can extend much further in some forms of design research, particularly in co-design and participatory design approaches. In these cases, participants may have full involvement in the design process, engaging in collaborative decision-making, co-creating tools or systems, and exercising more control over the research direction (Binder et al., 2019). This flexibility in how participation is defined reflects the different levels of participant involvement that can exist across various design contexts. Some research may focus on participant input for specific tasks or feedback, while other projects may embody a more collaborative ethos, with participants acting as co-designers in shaping both the research and its outcomes (Luck, 2007).

On a different note, in DRR, participation often goes much deeper, focusing on empowering marginalised or less vocal groups to contribute meaningfully to disaster preparedness and resilience-building efforts. DRR participation emphasises community engagement, with the goal of amplifying the voices of vulnerable people, such as children, to ensure that strategies reflect the needs and perspectives of those most affected by disasters (Wisner et al., 2012). This aligns with higher levels of participation, such as those described by Arnstein's (1971) Ladder of Participation, where individuals and communities are empowered to take part in the decision-making process and implementation, monitoring and evaluation of DRR actions.

This research occupies a middle ground between these two interpretations of participation. On the one hand, it adopts a user-centred design approach where participants offer feedback and insights that inform the iterative design process. While this aligns with traditional participatory design practices, it does not fully reach the highest levels of empowerment, as seen in DRR frameworks, where the goal is often community control or co-decision-making (Freire, 1993). On the other hand, the educational focus of the research seeks to inspire participants to actively engage in disaster preparedness learning, following a model of experiential learning rather than traditional instruction (Kolb, 1984). This

educational approach encourages participants to begin a journey of learning and self-reflection about disaster risks, aligning with Freire's (1993) critical pedagogy, which seeks to empower learners through self-directed, reflective action.

Thus, participation can serve two primary roles in these contexts: first, as a means of shaping design through user input, and second, as an educational tool that encourages deeper reflection and learning. While it may not achieve the highest levels of participation in terms of community empowerment, it fosters a participatory and educational process that encourages participants to engage with disaster preparedness concepts in a more meaningful way. Integrating these participatory and educational elements bridges the gap between user-centred design and the more comprehensive, community-focused participation as defined in DRR. This dual approach, combining participatory design with educational engagement, ensures that participants' inputs shape the research while also fostering a deeper understanding of disaster preparedness.

2.4.3. THE ROLE OF STORYTELLING IN DRR EDUCATION

In addition to the motivational benefits provided by gamification efforts, storytelling offers another powerful opportunity to engage children in Disaster Risk Reduction (DRR) education. While gamification appeals to the inherent motivations and cognitive development of children, storytelling taps into their emotional and imaginative capacities, creating a complementary strategy for fostering deep engagement and learning.

Storytelling, a tradition as ancient as humanity itself, serves as a powerful medium for conveying complex concepts in an accessible manner and making these concepts more easily digestible. Moreover, the power of storytelling lies in engaging the audience on a cognitive and emotional level, as narratives facilitate cognitive processing and emotional engagement, making them

effective for educational purposes in a variety of contexts and areas, including DRR. This engagement can play a vital role as it fosters a deep and meaningful connection to the subject matter, going beyond basic awareness to cultivate a genuine sense of empathy and understanding (Green & Brock, 2000). It's important to note that character-driven narratives are particularly effective in this context. Characters that exhibit qualities such as curiosity and problem-solving, reflective of Bruner's (J. S. Bruner, 1990) exploration of how narratives shape one's understandings, serve as mirrors for children, showcasing strategies to navigate life's challenges and potential risks. Drawing from the work of Hidi and Renninger (Hidi & Ann Renninger, 2006) on their four-phased model of interest development, it particularly highlights the importance of engaging content in fostering deep learning, emphasising its relatability and applicability to various contexts, such as child engagement in DRR.

This approach does more than prescribe actions; it invites children into a learning process by setting examples. The decisions of characters offer a roadmap for personal development, supported by Nikolajeva's (Nikolajeva, 2012) research on how narratives aid in the development of empathy. The effectiveness of this method, underscored by studies showing that stories with strong, relatable characters can profoundly impact a child's comprehension and memory of key life skills (Mar & Oatley, 2008). Furthermore, Zipes' (Zipes, 2012) examination of fairy tales emphasises the role of characters in shaping values and behaviours, demonstrating the timeless educational value of storytelling.

Empirical evidence supports the efficacy of storytelling in DRR education. Hidayati (2020) conducted a case study in Lombok, Indonesia, where a local storytellers' community implemented DRR education for preschool-aged children. The study found that storytelling effectively conveyed disaster preparedness concepts, making them accessible and engaging for young learners. Similarly, Rahiem (2020) explored the use of folklore in early childhood

disaster education, concluding that culturally relevant stories enhance children's understanding and retention of disaster-related information.

The implementation of storytelling in DRR education requires a deliberate and well-thought process to craft narratives that are both captivating and educational. The deployment of various mediums, including digital storytelling platforms, comic books, and interactive role-play activities, offer a wide range of possibilities for delivering these stories, each medium providing distinct benefits in terms of engagement and learning reinforcement. Robin & Pierson (2005) discuss the educational potential of digital storytelling, particularly its capacity to engage students and enhance learning through multimedia elements.

An indispensable element of utilising storytelling effectively in DRR education is the emphasis on cultural sensitivity and the inclusion of diverse experiences. Narratives must be reflective of and relevant to the varied backgrounds and realities of children, integrating local knowledge and practices of disaster preparedness to ensure the content is not only educative but also respectful and validating of different community experiences. Paulo Freire's concept of dialogue as a means of critical pedagogy underpins this approach, advocating for educational processes where learners are active participants, engaging with their cultural contexts and perspectives, which is essential for fostering critical consciousness in DRR education. Drawing on Paulo Freire's concept of critical consciousness, DRR education should encourage learners to reflect critically on their own realities and the socio-cultural dynamics shaping their experiences (Freire, 1993). In alignment with Freire's principles, Paris and Alim (Paris & Alim, 2017) advocate for culturally sustaining pedagogies that respect and incorporate the cultural histories and narratives of diverse student populations. Collaborating with local communities in the narrative development process not only enhances the accuracy and relevance of these stories but also fosters a sense of empowerment and ownership among participants, promoting a more inclusive and empathetic approach to DRR education (Mochizuki & Bryan, 2015).

2.5. GAPS IN THE LITERATURE

Despite the substantial contributions of existing literature in the domains of design probes, children's participation in DRR, and the integration of gamification and storytelling elements in educational contexts, several gaps remain in terms of their application, integration, and empirical evaluation in real-world DRR settings. Although many studies have explored each of these domains independently, their intersections, particularly regarding children's engagement in DRR through participatory and creative methods, remain underexplored and methodologically inconsistent. Current research tends to either focus on educational interventions for children in DRR or participatory design processes, but few studies bridge these areas effectively to assess their combined impact. These gaps not only highlight the call for further research connecting these domains but also underscore potential opportunities for innovative exploration and deeper understanding within these interconnected fields.

Explicitly integrating design probes in DRR while incorporating elements of gamification and storytelling as complementary participatory tools. Prior studies have largely examined gamification and storytelling in isolation within disaster education (e.g., digital storytelling for risk communication or serious games for training exercises), but the potential of combining these approaches within design-led interventions remains largely untested. Moreover, design probes allow for a deeper exploration of participants' viewpoints, wishes, desires, and fears of their day-to-day lives, which remains an untapped area in the realm of DRR. This deeper exploration of participants' individual experiences allows for a richer, more nuanced understanding of the personal and communal impacts of potential disasters on the participants. Additionally, the use of design probes, particularly in the context of DRR, serves as a bridge connecting children's imaginative worlds with the practical needs of disaster preparedness. Through activities that encourage reflection, expression, and creativity, children can

articulate their understanding of disasters, their impact, and possible mitigation strategies in ways that are both insightful and actionable.

2.5.1. LIMITED EMPIRICAL RESEARCH ON DESIGN PROBES IN DRR CONTEXTS

The application of design probes within DRR, particularly for children's engagement, represents a novel yet underexplored area. While the utility of design probes has been established in various domains to solicit deep, insightful responses and foster creativity, their specific adaptation and efficacy in the DRR sphere, especially among younger populations, remain scarcely documented (Gaver et al., 1999a; Mattelmäki, 2006). Existing research on participatory tools in DRR has primarily focused on surveys, interviews, and workshops, with few studies investigating how creative methodologies like design probes can facilitate meaningful engagement with children. Furthermore, most studies that do use probes focus on adult-centred applications in urban planning, healthcare, or service design (Boehner et al., 2007; E. B. N. Sanders & Stappers, 2014), leaving a gap in knowledge regarding their potential to engage children in disaster preparedness.

For instance, a review by Johnson et al. (2014) emphasises the importance of engaging children in disaster learning through participatory methods but does not investigate how exploratory design tools like design probes might enhance these efforts by capturing children's lived experiences, perspectives, and adaptive strategies. Similarly, research on participatory disaster education (e.g., Hidayati, 2020; Rahiem & Rahim, 2020) has explored how storytelling can support risk communication but has not examined how co-designed design probes might complement these approaches.

This gap underscores a critical need for research focused on customising design probes to children's perspectives and experiences with disasters, thereby exploring how these tools can go beyond conventional educational models to foster deeper engagement, agency, and long-term learning (Hulkko et al.,

2004b; Yoon & Templeton, 2019). Future studies should examine how design probes can be systematically evaluated within DRR education to assess their effectiveness in improving children's knowledge retention, emotional preparedness, and participatory role in resilience-building efforts.

2.5.2. UNDER-REPRESENTATION OF CHILDREN'S AGENCY IN DRR

Despite growing acknowledgment of the critical role children play in enhancing community resilience, there exists a significant disconnect between the theoretical advocacy for child agency in DRR and the practical methodologies used to facilitate it. The current body of research often portrays children as passive recipients of disaster education rather than active contributors to resilience-building processes (Muzenda-Mudavanhu, 2016; Peek, 2008). This oversight ignores the potential for children's unique insights and innovative ideas to contribute meaningfully to disaster preparedness and mitigation strategies. There is a pressing need for studies that delve into the mechanisms through which children's participation in DRR can be amplified and effectively involved in informing community resilience efforts (Anderson, 2005; Mitchell et al., 2009).

Recent participatory research in climate adaptation (Fleming et al., 2020) and disaster recovery (Cox et al., 2017) has demonstrated that when children are given structured opportunities for engagement, their contributions can influence preparedness planning and even shape local disaster policies. However, these studies primarily rely on focus groups and surveys rather than interactive, design-led methods that empower children to articulate their perspectives creatively. While approaches like child-led mapping and participatory videos have gained traction (Hore et al., 2018; Towers, 2016), the potential of design-based methodologies to support child agency in DRR remains largely unexplored.

There is a pressing need for research that moves beyond documenting children's participation to actively fostering their role as co-creators in DRR strategies. Investigating methodologies that empower children as innovators in disaster preparedness, including design probes, co-creation workshops, and interactive tools that allow children to design their own DRR solutions, could significantly enhance the field (Hore et al., 2018; Ronan et al., 2015a; Towers, 2016). This research gap suggests a need for comparative studies that evaluate the impact of different participatory methods, providing empirical evidence on the most effective strategies for integrating child agency in DRR.

2.4.2. GAMIFICATION ELEMENTS IN DESIGN PROBES: ENHANCED CHILD ENGAGEMENT IN DISASTER RISK REDUCTION

Gamification is a persuasive technology that incorporates game-playing elements into non-game environments and contexts to improve user engagement, motivation, and outcome achievement (Blohm & Leimeister, 2013; Deterding, Sicart, et al., 2011). This approach, which closely relates to concepts of serious games and games with a purpose, has its roots in human-computer interaction (HCI) dating back to the early 1980s (Malone, 1982). The evolution of gamification has introduced various parallel terms like serious play, productivity games, and playful design, showcasing its wide range of potential applications across various fields and contexts, such as health and education (Pereira et al., 2014; Ružic & Dumancic, 2015). Moreover, Gamification emphasises gamefulness, gameful interaction, and gameful design to enrich experiences within a 'safe' environment that encourages exploration and learning (Chee, 2015). This is particularly relevant in settings where the players have a sense of control, which significantly encourages innovative thinking and learning (Dignan, 2011; Shneiderman, 2004). Rooted in Self-Determination Theory (SDT), gamification also fulfils psychological needs by providing autonomy through choices, competence via challenges, and relatedness through social interactions (Nicholson, 2012; Ryan & Deci, 2000). Empirical studies across educational settings have demonstrated the positive effects of gamification on motivation

and engagement, suggesting its potential efficiency and effectiveness in DRR education for children (Hamari et al., 2014).

In the evolving field of DRR, the integration of gamification strategies has emerged as a transformative approach to redefining educational activities and learning encounters. In educational settings, gamification offers a dynamic framework to foster engagement, participation, and motivation among learners (Hamari et al., 2014). This approach capitalises on the intrinsic motivation and engagement that games naturally elicit, thereby encouraging sustained interaction and deeper learning (Deterding, Dixon et al., 2011). However, the design and implementation of gamification within educational settings, especially those focused on disaster preparedness, necessitate a meticulous approach. It is imperative to tailor the applied game elements to be age-appropriate, ensuring that they resonate with the developmental stage and learning capabilities of the target demographic (Kapp, 2012). This alignment is crucial not only to captivate interest but also to facilitate meaningful learning experiences that extend beyond superficial engagement (Plass et al., 2015; Salen Tekinbas & Zimmerman, 2003). Furthermore, the integration of gamification into DRR engagement must be strategically aligned with educational goals and objectives, to ensure that the introduction of game elements serves to enhance understanding, exploration, and discovery of DRR concepts rather than detracting from the importance of the subject matter (Landers, 2014).

Recent studies have explored how gamification can be applied effectively in DRR education. Kankanamge et al., (2020) conducted a systematic review of gamification in disaster education, analysing various game-based interventions such as simulation-based training, role-playing, and interactive digital platforms. The study concluded that while gamification significantly enhances engagement and knowledge retention, long-term evaluation mechanisms are still lacking, making it difficult to assess its sustained impact on DRR preparedness. Similarly, Lin et al., (2013) examined game-initiated learning in Taiwan, using a mix of

digital and non-digital gamified activities to teach disaster preparedness concepts. The study measured children's engagement and knowledge retention through pre- and post-tests, finding that interactive storytelling and reward-based learning improved their ability to recall disaster preparedness strategies weeks after the intervention. These findings suggest that gamification can support experiential learning in DRR, especially when integrated with interactive and immersive activities.

To this end, educators, researchers, and designers are tasked with maintaining a delicate balance of leveraging the motivational affordances of gamification while reserving the educational integrity and outcomes of DRR programs (A. V. Gampell et al., 2019). This balance calls for an understanding of the different ways in which gameful design can support learning theories and cognitive development (Ryan & Deci, 2000). As a result, effective gamification in DRR approaches should draw on empirical research and best practices, creating experiences that foster disaster resilience among learners and initiate conversations in communities through both engaging and pedagogically sound approaches (Caponetto et al., n.d.).

One area of growing interest is the use of gamified probes to engage children in various topics and contexts like disaster preparedness and risk reduction. Samsó et al. (Samsó et al., 2017a) developed a gamified cultural probe approach aimed at increasing children's awareness of energy consumption habits, integrating "missions" and digital reward mechanisms to sustain engagement. The study found that incorporating game mechanics such as progress tracking, achievement badges, and social collaboration significantly increased children's motivation to complete tasks and reflect on their behaviours. This research provides valuable insights into how gamified probes could be applied to DRR, transforming probes from passive reflection tools into engaging, interactive experiences that encourage deeper learning, exploration, and participation.

Understanding children's cognitive development is also especially crucial when designing educational tools and activities that require complex critical thinking. Cognitive development, according to Piaget (1952), progresses through stages, with children developing the ability to think abstractly, solve problems, and understand complex ideas as they grow (Bronfenbrenner, 1979). In a way, bringing elements of gamification to probe activities adds an element of fun, but also capitalises on children's natural tendencies towards play and exploration, which are critical components of learning and engaging with complex subjects.

From a developmental perspective, the use of design probes allows researchers to explore how children's realities are shaped by their cognitive and emotional frameworks. Bronfenbrenner's Ecological Systems Theory (1979) is particularly relevant here, as it posits that a child's development is influenced by the various systems they interact with, ranging from immediate environments (microsystem) to broader societal contexts (macrosystem). Figure 4 illustrates Bronfenbrenner's ecological system, depicting how various ecological layers influence children's development and their understanding of societal issues such as disaster preparedness. This also relates to how they view concepts like disasters or disaster preparedness. Gamified probes, when thoughtfully designed, can serve as experiential learning tools by embedding disaster-related challenges within familiar, playful environments. By engaging in interactive tasks that simulate real-life DRR scenarios, children not only develop a better understanding of preparedness strategies but also experience a sense of agency in navigating potential disaster situations. Gamified probes can be designed to reflect these systems, offering scenarios that challenge children to think critically about their roles within their families, schools, and communities in the context of DRR. This approach not only provides insights into the children's cognitive and emotional processing but also encourages them to consider their interconnectedness with others and the broader environment (Blair & Raver, 2015).

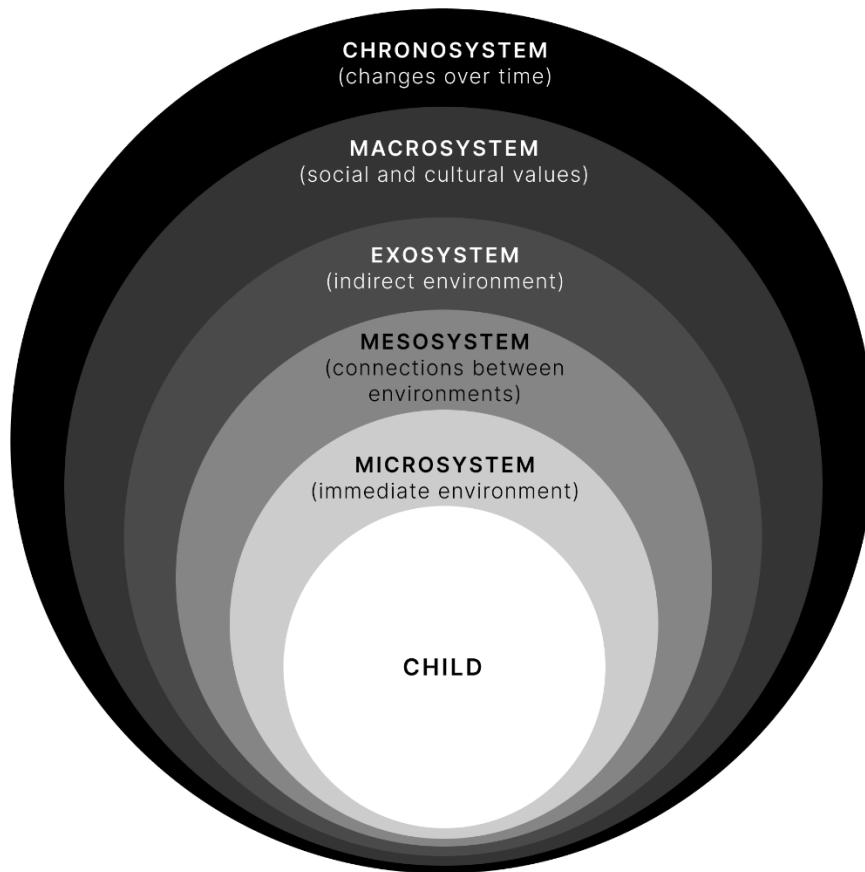


Figure 4. Urie Bronfenbrenner's Ecological Systems Theory

2.5.3. THE EFFICACY OF GAMIFICATION AND STORYTELLING

The application of gamification and storytelling in education represents a promising path for engaging children in DRR, yet there remains a gap in empirical research assessing the direct impact of these methods within disaster education contexts. While the motivational benefits of gamification and the narrative power of storytelling are well-documented in educational psychology and learning sciences, their potential to enhance disaster preparedness and resilience among children remains underexamined (Deterding, Dixon, et al., 2011; Green & Brock, 2000). This gap highlights a need for more comprehensive research that not only evaluates the impact of these techniques on children's learning outcomes and engagement but also explores how they can be strategically integrated into

DRR education to foster a deeper understanding of disaster risks and mitigation strategies.

Research should focus on developing and testing gamified learning environments and storytelling frameworks that are specifically designed for DRR education. Such studies could assess the effectiveness of these approaches in improving children's knowledge, skills, and attitudes towards disasters, comparing them with more traditional, top-down educational methods. Furthermore, examining the role of narrative immersion and game mechanics in facilitating long-term engagement and retention of DRR concepts could provide valuable insights for the design of future educational interventions (Hamari et al., 2014).

Addressing these identified gaps requires a multidisciplinary research approach that combines insights from design, education, psychology, and disaster management. By focusing on these underexplored areas, future studies can contribute significantly to developing more engaging, effective, and child-centred DRR education strategies. Such research is not only essential for filling the existing gaps in the literature but also for informing the design of innovative DRR interventions that can effectively harness the potential of children as key stakeholders in disaster preparedness and resilience efforts. Figure 5 showcases the interconnecting areas of research as well as the research gap.

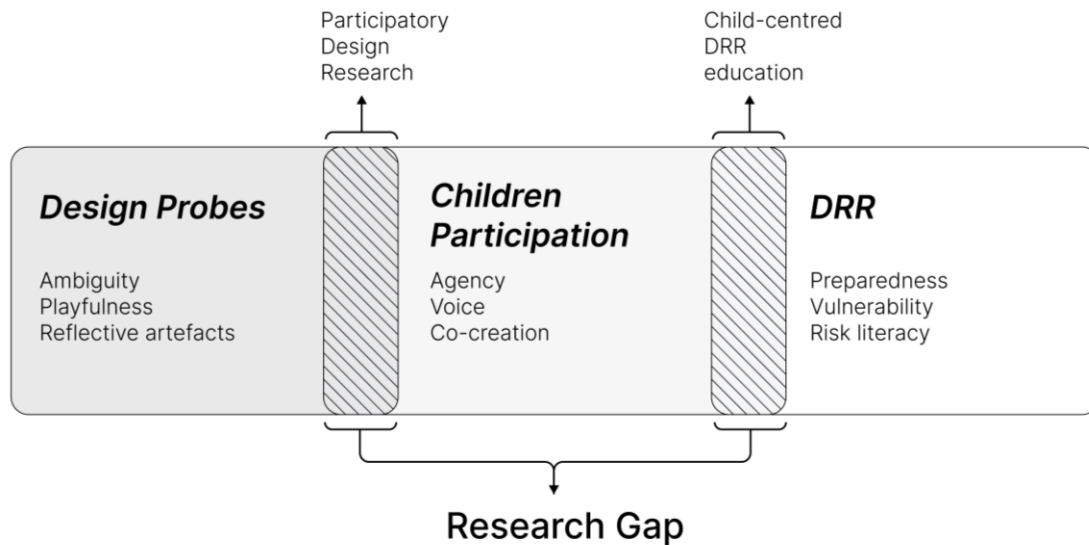


Figure 5. Interconnections of the research areas and identification of the research gap


2.6. CHAPTER SUMMARY

This chapter of this thesis examines the existing body of knowledge surrounding the intersection of DRR with innovative design methods, particularly focusing on the utilisation of design probes and the active involvement of children in DRR initiatives. It brings to light the often-overlooked potential of children as resilient agents capable of contributing significantly to disaster preparedness and mitigation strategies. Despite traditional perspectives that predominantly view children through the lens of vulnerability, emerging research underscores their inherent qualities of adaptability, imagination, and creativity, which are invaluable in the context of DRR. This chapter establishes that current scholarship has yet to fully integrate children's creative and adaptive capacities into mainstream DRR practice and further explores how design probes, used as tools of engagement and exploration, can be tailored to harness these qualities, thereby fostering a participatory approach that moves beyond awareness-building toward meaningful involvement and innovation.

Further, the review delves into the methodologies and outcomes of incorporating gamification and storytelling into DRR education, highlighting their effectiveness

in enhancing engagement, understanding, and emotional connection to the subject matter. Through an examination of existing applications across various fields, the chapter identifies a significant gap in empirical research regarding the specific use of design probes in DRR, especially in engaging children. It highlights that while innovative DRR methods exist, they often remain disconnected from children's lived experiences, and conventional DRR education still relies heavily on instructional models that limit agency and creativity.

These shortcomings suggest that there is still considerable room for developing and strengthening design-led, participatory tools within DRR practice. By bridging this gap, the thesis aims to contribute to the development of more inclusive, effective, and child-centred DRR strategies, acknowledging the pivotal role that children's perspectives and innovations can play in building resilient communities and fostering a culture of preparedness that is both deep-rooted and widespread. The chapter therefore sets the direction for future chapters: to investigate how design probes can be operationalised, evaluated, and optimised to empower children as proactive contributors in DRR.



"The details are not the details. They make the design..."

– Charles Eames

CHAPTER 3 – RESEARCH METHODOLOGY

3.1. CHAPTER INTRODUCTION

This chapter outlines the methodological framework in this study, aimed at exploring and enhancing the creative agency of children in the context of DRR through the innovative use of design probes. In an era where the unpredictability of disasters calls for resilient communities, the inclusion of children's perspectives and creative contributions becomes not just relevant but imperative. The methodology developed here is underpinned by a commitment to bringing out the imaginative voices of children, exploring their viewpoints, and encouraging them towards a path of learning and discovery about disasters and disaster risks. This approach recognises the unique insights children can offer in creating resilient futures, thus fostering an environment where their ideas and innovations are not just heard but are instrumental in shaping disaster preparedness initiatives.

This research takes a mixed-method approach, combining qualitative inquiry with design-led exploration to foster creativity and deeper engagement of participants. The methodology reflects the study's interdisciplinary nature, bringing together design and DRR to bridge the gap between theory and practice. The goal is not only to contribute academically but also to generate practical, real-world insights that enhance disaster preparedness efforts. At the core of this approach are design probes, which serve as both tools for engagement and inquiry. They not only help capture children's perceptions and creative responses to disaster risks but also create an interactive and reflective learning experience, encouraging children to think critically about preparedness in a way that feels meaningful and engaging.

In the following sections, the research design and methodology are articulated in detail, starting with an overview of the research paradigms that inform this study's real-world context. This is followed by a discussion on the research

design and goals, the identification of the choice of research method, and an in-depth exploration of the qualitative research approach adopted, including the subjectivity and reflexivity of the researcher. The chapter further delves into the specifics of data analysis, study population and data collection methods, ethical considerations, and the integration of interviews and thematic analysis with the design probes. Lastly, the thematic analysis procedures and their integration with theoretical frameworks are discussed, culminating in a summary that encapsulates the essence of the methodology chapter. To provide a clear visual overview of how the research questions, methodological choices, and analytical processes are interconnected, Figure 6 illustrates the overall structure of the study. It maps the relationship between the research questions, the design-led methods employed, and the sequential flow from literature review through probe development, data collection, and thematic analysis.

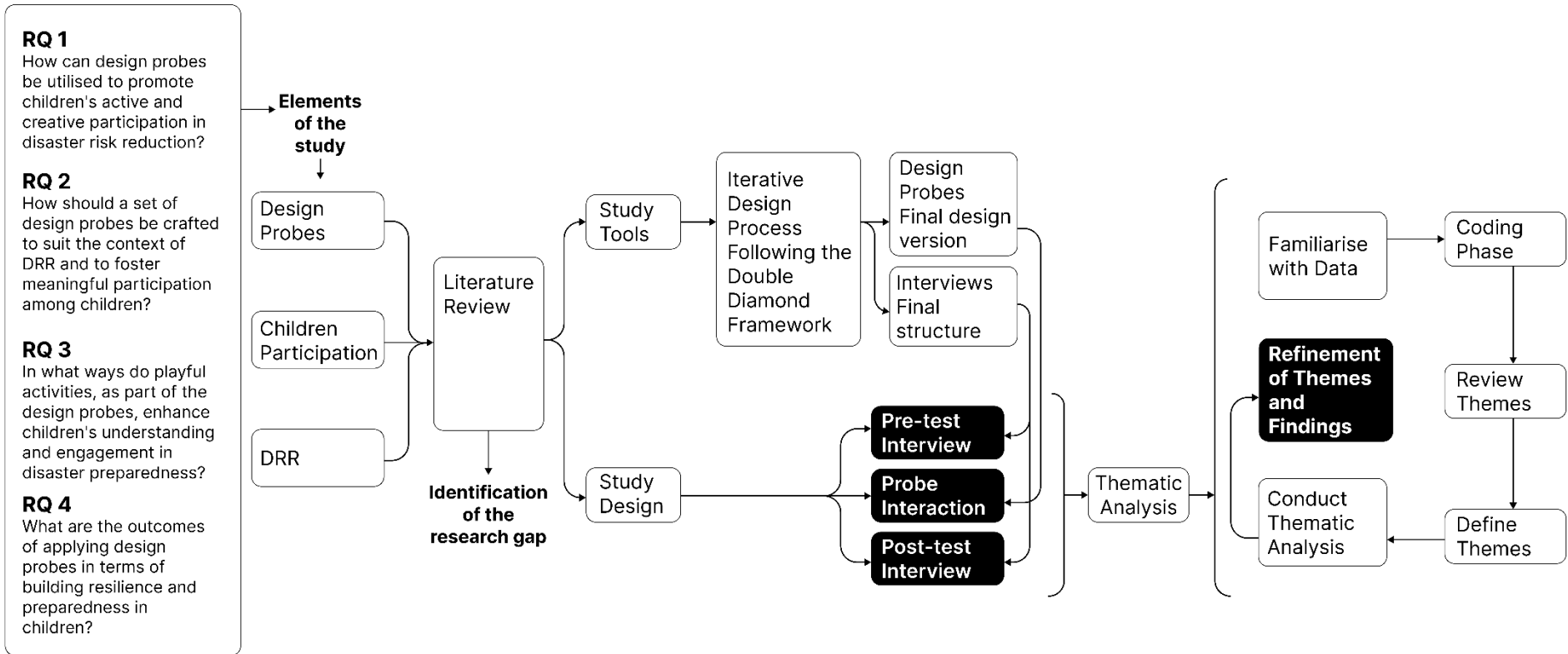


Figure 6. Overview of the methodological framework showing how the research questions and literature review informed the study design through to thematic analysis.

3.2. RESEARCH DESIGN AND METHODOLOGY

3.2.1. RESEARCH PARADIGMS IN REAL-WORLD CONTEXT

A research design serves as a structured plan that guides the systematic investigation of research questions while addressing the complexities of real-world contexts (Marczyk et al., 2010; Salkind, 2010). Evans (2010) defines it as a detailed outline that specifies the methods, timing, and locations for gathering and analysing data, whereas Polit & Beck (2010) view it as a comprehensive approach developed by the researcher to tackle research questions or verify hypotheses through various design methods, including qualitative, quantitative, and mixed methods approaches. In the context of this study, where the focus is on using design probes to promote participation and engagement of children in DRR, the research design serves as a blueprint that integrates these methodological considerations to address the unique challenges of involving children in DRR efforts.

Research is shaped by philosophical perspectives that define how reality and knowledge are understood. These foundational beliefs, or paradigms, guide the researcher's approach to ontology (the nature of reality), epistemology (how knowledge is constructed), and methodology (how knowledge is investigated) (Heigham & Croker, 2009). In the context of this study, which explores children's creative engagement in DRR through design probes, the chosen paradigms must support an understanding of how children perceive and internalise disaster-related concepts. Ontology (the nature of reality), epistemology (how knowledge is constructed), and methodology (how knowledge is investigated) all play a crucial role in shaping an approach that prioritises children's agency and participatory learning. These paradigms directly influence the formulation of research questions and the selection of data collection and analysis techniques, ensuring that the study captures the subjective, imaginative, and interactive ways children engage with disaster preparedness (Heigham & Croker, 2009; Levitt et al., 2018).

While researchers have previously identified and proposed paradigms, Candy (1989) argues that they can essentially be categorised into three primary groups: positivist, interpretivist, or critical paradigms. Some researchers propose the addition of a pragmatic paradigm, which merges elements from the first three while also embracing post-positivism to form a more holistic framework (Kivunja & Kuyini, 2017). The positivist paradigm supports the discovery of a singular, universal truth through empirical research, emphasising objectivity and the reduction of researcher bias, closely aligning with the scientific method (Heigham & Croker, 2009; Kivunja & Kuyini, 2017). Conversely, the post-positivist paradigm acknowledges the complexity of human behaviour and the potential for multiple truths, particularly in the social sciences, suggesting that absolute truth might be unattainable (Rehman & Alharthi (2016).

On the other end, interpretivism and constructivism stress the subjective nature of reality. Rehman & Alharthi (2016) describe interpretivism as countering the predominance of positivism by rejecting the idea of an objective reality that is independent of human perception. This stance, grounded in an anti-foundationalist ontology, refutes the existence of universal truths (Lincoln & Guba, 2016). Interpretivists and constructivists view truth and reality as socially constructed, influenced by individual perceptions and backgrounds. The constructivist paradigm, specifically, posits that individuals form their own meanings based on their experiences, with researchers aiming to understand these meanings within the influences of time, culture, and social-political contexts (Creswell & Creswell, 2022). Both paradigms are dedicated to comprehending the intricacies of human experiences and the subjective nature of knowledge. Applying the constructivist paradigm, this study seeks to understand how children perceive and engage with DRR-related concepts through their interaction with design probes. By acknowledging the fact that each child constructs their own understanding, this study aims to capture these individual experiences to enhance DRR strategies.

Critical theory views reality to be historically and socially constructed, influenced by cultural, political, and other social factors (Kivunja & Kuyini, 2017). It adopts a subjective stance and calls for clarity in researchers' philosophical positions to prevent confusion about their investigative perspective (Kincheloe et al., 2011). Critical theorists urge for scrutiny of knowledge, especially that which is upheld by dominant power structures. In the context of this study, they inform the examination of DRR education practices, questioning whether they adequately motivate children's participation. This critical lens helps identify gaps where children's creative contributions can enhance DRR efforts.

Furthermore, pragmatism, which is the guiding paradigm for this study, operates beyond conventional epistemological and ontological confines. It focuses on solving significant issues and delivering solutions, regardless of the philosophical biases of the researcher. Although pragmatism often allows for employing both quantitative and qualitative this study adopts a purely qualitative approach to examine a problem from diverse perspectives, seeking practical solutions. The pragmatic approach aligns with my research objectives by emphasising practical outcomes, specifically enhancing children's engagement and participation in DRR through innovative design probes. By integrating constructivist and critical perspectives within a pragmatic framework, my study seeks real-world applications that empower children as active participants in disaster preparedness. Pragmatism acknowledges that truth exists both as an external entity and as constructed by individuals within their unique socio-political, cultural, and temporal contexts (Kivunja & Kuyini, 2017).

3.2.2. RESEARCH DESIGN

The research design of this study is inherently interdisciplinary, integrating insights from the realm of design and disaster management. It aims to bridge the gap between theoretical frameworks and practical applications in DRR education for children. To address the challenges of DRR and emphasise the critical involvement of children, this thesis adopts a research design that weaves

together the theoretical foundations with pragmatic applications. This approach fills a notable gap in the literature, where there is limited research on engaging children creatively in DRR through participatory design methods. By focusing on design probes as tools for engagement, this research contributes new insights into effective strategies for involving children in DRR initiatives.

The study is structured around three main phases, diverging from conventional workshop-centric methods. It begins with an online interview to understand and explore the participants' initial perceptions and knowledge regarding disasters and disaster preparedness, setting a baseline for their engagement in DRR. This step is crucial for assessing the starting point of each participant's journey of discovery and learning within the disaster preparedness space. Subsequently, the design probes are delivered to the children. These probes, carefully designed to inspire participants towards a path of discovery and learning about disasters, are not intended for direct instruction on disaster preparedness measures. Instead, their design aims to initiate thought and stimulate curiosity, encouraging children to explore disaster-related concepts actively and through their own agency. This innovative use of design probes addresses the lack of interactive, child-centred approaches in DRR, providing a method for children to engage with complex concepts in a manner that is both accessible and empowering.

The final stage of the study involves a second online interview (post-test) assessing the impact of the probes on the participants' understanding of understanding and engagement with DRR. This structured approach facilitates a thorough evaluation of the probes' effectiveness in promoting disaster preparedness and awareness among children. Figure 7 illustrates the main stages of the overall study design.

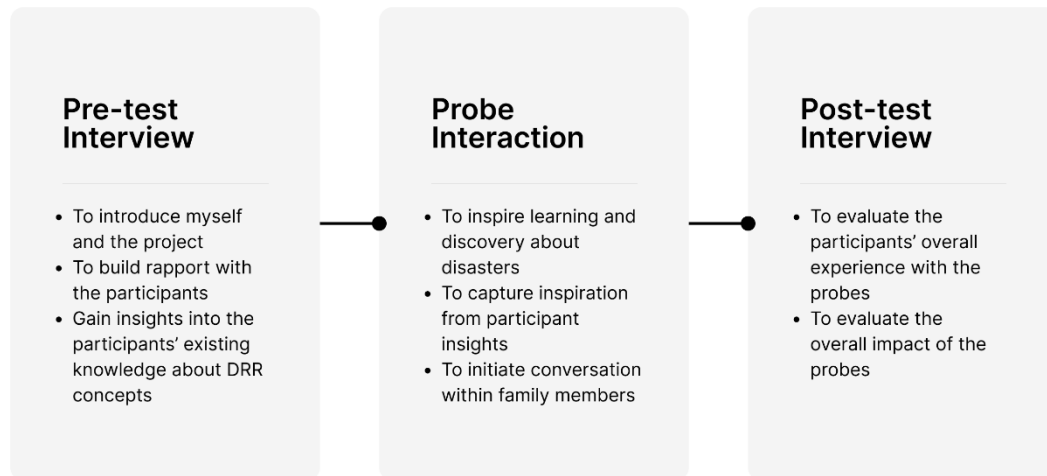


Figure 7. Overview of the study design

Crucially, the choice of using design probes as the main means of investigating research objectives was carefully evaluated and eventually applied due to the probes' open-ended and customisable nature (Graham et al., 2007). Moreover, design probes possess two main qualities that make them the perfect fit for this study and its goals: the ability to gain inspiration and information about the participants and explore their views, understandings, wishes, and fears, as well as the ability to inspire and spark curiosity and meaningful action in participants (Mattelmäki, 2006a). By taking advantage of these qualities, this research not only collects valuable data on children's perceptions but also actively engages them in a path of learning and discovery about disasters and disaster risks, fostering a deeper connection with DRR concepts.

In the case of this study, design probes represent an innovative and compelling approach towards involving children in DRR because of their unique qualities, such as their ability to elicit rich, qualitative insights and inspire creative engagement. These qualities make them particularly suited to engaging young minds in exploratory and reflective learning processes.

This method fills a gap in current DRR education practices, which often lack interactive and participatory elements that specifically cater to children's creative capacities. By implementing design probes, this research offers a novel approach that can be adopted or adapted in future DRR initiatives.

This methodology can be particularly effective in the context of DRR, a field that requires an understanding of complex, often abstract concepts related to risk and safety. By transforming these concepts into tangible, interactive experiences; design probes enable children to internalise and reflect upon disaster preparedness in a deeply personal and meaningful way.

Moreover, design probes serve as a valuable research tool as they offer insights into children's perceptions, ideas, and solutions regarding disaster preparedness that might not emerge through more conventional research methods. They provide a unique window into the imaginative and innovative ways children think about and understand disasters, facilitating the collection of rich, qualitative data that can inform more effective DRR strategies and educational programs tailored to young audiences. This capability to elicit expressive and creative responses from children not only enriches the research data but also empowers participants, recognising them as active contributors to the discourse on disaster preparedness. By empowering children in this way, this research aims to support the development of more resilient communities and foster a culture of disaster preparedness and awareness from a young age. Given the critical importance of building resilience from an early age, design probes emerge as a reliable and effective method for engaging children in DRR, fostering a culture of preparedness that integrates their perspectives and leverages their potential as change agents within their communities.

The development of the probe activities underwent an extensive design process that was structured around the double diamond framework, a model in design research that emphasises divergent and convergent thinking stages to foster

innovation and effective problem-solving. Furthermore, the design of the probe activities was informed by the literature on design probes and their applications within similar contexts, including piloting sessions with smaller participant groups. This iterative design process ensured that the probes were both theoretically grounded and practically effective. By incorporating feedback from pilot studies, the probes were refined to better meet the research objectives and engage participants more meaningfully.

The literature review in the design phase was also crucial in exploring how probes can be designed and utilised to achieve certain goals and understanding the critical attributes that contribute to how a set of probes would play out. Derix & Leong (2019b) bring attention to existing guides and frameworks around designing probes and how qualities such as openness/boundedness, pace, and challenge can impact the depth of the probes' exploration and elicitation of information. Figure 8 illustrates the spectrum of these qualities, showing how different types of probe activities (e.g., icebreaker probe activities and deeper reflective probe activities) can be positioned along three dimensions: openness versus boundedness, fast versus slow pace, and low versus high challenge. For instance, icebreaker probes are typically more bounded, faster-paced, and lower in challenge, making them suitable for initial engagements. In contrast, probes designed for deeper reflection are more open-ended, slower-paced, and higher in challenge, allowing participants to engage in a more profound and thoughtful exploration of the research themes. This visualisation helps clarify how varying these dimensions can tailor probes to meet specific research objectives and participant needs. These qualities were carefully taken into account when designing different versions of probe kits in this study to ensure participants have a sustained motivation to engage with the probe materials.

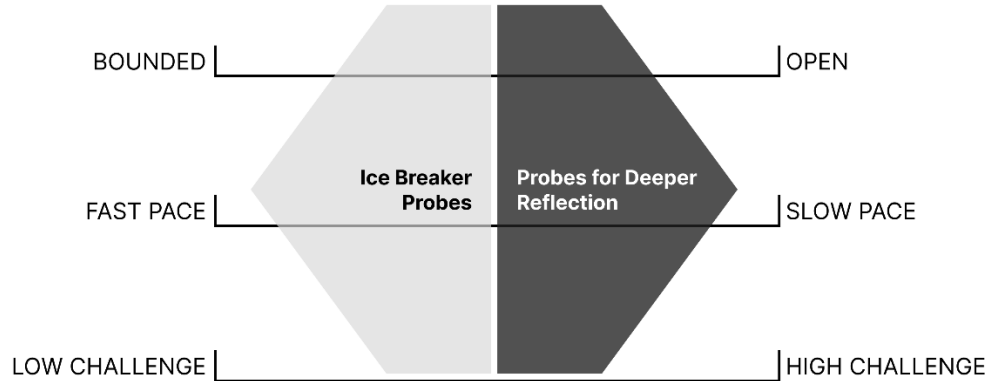


Figure 8. Contributions of three design properties to different probe functionalities

After the extensive review of the literature, the following phase of this iterative design process aimed at refining the probes to their optimal configuration, highlighting the participatory nature of the design of this study, where feedback from initial engagements significantly shaped the activities', a final form inspired by user input that design researchers such as Sanders et al. (2008) have previously brought attention to. To this end, multiple versions of the set of probes were tested among different groups of participants, taking their feedback and engagement into account in order to make revisions for the upcoming versions. The primary objective of the probes was to explore children's perceptions, creative ideas, and understanding of disaster preparedness while encouraging them to engage with these concepts in a reflective and imaginative way. In this phase, careful attention was paid to the challenges and strengths of each probe prototype that was put into testing. This was also a great opportunity to examine to what extent each of the probe activities was successful in contributing to the research objectives and propositions. Additionally, these iterative prototype tests presented a chance to explore the participants' views to inform the following design decisions, aligning with the foundational principles of user-centred design by directly involving the target audience in the development process.

This approach not only democratises the design process but also ensures that the final product is closely aligned with the participants' needs, preferences, and experiences. By actively incorporating feedback from these prototype tests, the design decisions made subsequently are deeply informed by the insights and lived experiences of the participants. This engagement is crucial for creating probes that are not only functionally effective but also resonate on a personal level with the children involved, fostering a deeper connection and understanding of the DRR concepts being explored. Figure 9 presents the alignment of the design process stages within the double diamond framework, illustrating the systematic stages that the study design has gone through.

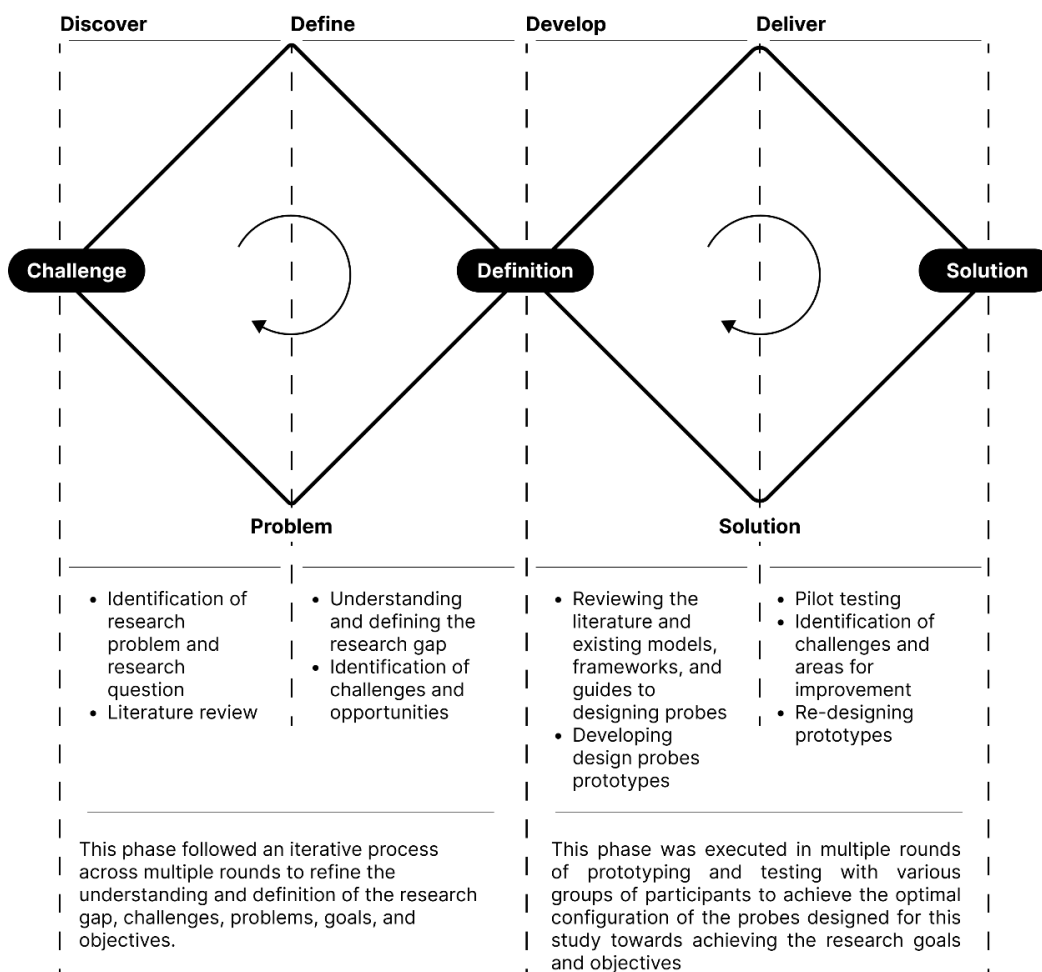


Figure 9. Design Stages in the Double Diamond Framework.

3.3. QUALITATIVE RESEARCH

The realm of qualitative research is a broad and evolving area rooted in diverse academic bases such as anthropology, sociology, and philosophy. It represents a methodological approach widely used across different disciplines within the social sciences and art studies (Heigham & Croker, 2009). This complex area fosters a range of research methodologies, including but not limited to narrative inquiry, case studies, ethnographic research, action research, phenomenological studies, and grounded theory. In this study, qualitative methods are employed to explore the unique ways in which children engage with DRR concepts through design probes. By focusing on children's perspectives, this approach provides an in-depth understanding of their experiences, perceptions, and creative outputs, which quantitative methods might not capture effectively. The qualitative approach aligns with participatory disaster research, which prioritises lived experiences and co-constructed knowledge (Peek et al., 2018; Towers et al., 2014).

The paradigm values the subjective interpretation of events, influenced by wider societal, political, cultural, and historical contexts, thereby offering deeper insights into the phenomena being investigated. Originating from a subjectivist epistemology, qualitative research employs inductive logic to reveal the intricate realities individuals experience (Creswell & Creswell, 2022). This study adopts an inductive approach to uncover emergent themes in children's understanding of DRR, following Braun and Clarke's (Braun & Clarke, 2006) thematic analysis framework. The interpretive nature of this process allows for the identification of patterns in children's engagement with DRR through the probes, ensuring that the findings are deeply embedded in their narratives rather than predefined categories.

For data collection, qualitative research employs techniques such as observations, interviews, open-ended questionnaires, and diaries. Each method

provides a distinct perspective on the topic, enabling a detailed and multifaceted comprehension of the participants' views (Denzin & Lincoln, 2011) In this study, semi-structured interviews and the design probes themselves serve as primary data collection tools. The pre-test and post-test interviews capture children's evolving perceptions, while the design probes generate creative artefacts that provide additional layers of insight. These methods, combined, align with methodological triangulation, which enhances the credibility of qualitative research finding (Flick, 2018).

In qualitative research, the researcher actively participates in data collection, becoming a key component of the investigative tool. Subsequently, in this study, semi-structured interviews were conducted with children before and after their engagement with the design probes. This approach provided a structured yet flexible method for exploring children's thoughts, feelings, and opinions on DRR, aligning with qualitative inquiry's emphasis on capturing lived experiences (Clarke & Braun, 2017). The pre-test and post-test interview method enabled a comparative analysis, allowing the researcher to assess shifts in participants' understanding and motivation to learn about disaster topics. By examining changes in their responses, it was possible to evaluate the impact of the probes on their engagement with DRR concepts and their evolving perspectives on preparedness and resilience.

Moreover, the researcher's involvement with the data goes beyond mere gathering; it includes an interpretive phase where patterns and themes are identified, enriching the study with a detailed comprehension of the context and its participants. In this study, thematic analysis was applied to both the interview transcripts and design probe artefacts, allowing for an in-depth examination of children's evolving understanding of DRR. This approach aims to ensure that the data interpretation remains grounded in the participants' own narratives rather than imposed frameworks, reinforcing the study's commitment to child-centred qualitative research (Towers et al., 2014).

3.3.1. THE SUBJECTIVITY AND REFLEXIVITY OF THE RESEARCHER

In the context of qualitative research, the researcher plays a key role, acting not only as the primary instrument for data collection but also as a key figure in its analysis. This involves two main aspects. Initially, the researcher actively participates in data gathering, utilising techniques like observations or interviews with participants (Denzin & Lincoln, 2011). This proactive stance allows for adaptability and the capacity to respond to the subjects and the study's context, enabling the pursuit of unforeseen research opportunities and the evaluation of diverse data types. The benefit of such engagement is the rapid interpretation of concepts, thereby enhancing the precision of the subsequent analysis phase. Secondly, the interpretation of data is a crucial phase. The unprocessed data, from observational notes and interviews to questionnaire responses and diary records, do not inherently reveal the underlying patterns of reality. The researcher must undertake what is often referred to as interpretive analysis to discover these patterns, a process endorsed by Merriam (2002).

However, researchers enter their study environments with personal biases informed by their intellectual understandings and life experiences, which are shaped by a multitude of factors, including gender, age, ethnicity, cultural background, and personal beliefs. These factors influence their perspectives and thus affect their perception of the research setting and the co-created interpretations of reality with participants. This inherent bias represents a significant obstacle in qualitative research, necessitating researchers to be critically conscious and methodically reflective about the influence of their identities on their work (Rossman & Rallis, 2010). Acknowledging and documenting this introspection in the results is essential. To counteract these biases, qualitative researchers typically employ triangulation, seeking varied viewpoints by gathering data from multiple sources and employing various data collection methods, such as observations, interviews, and surveys. This rationale underpins the choice of methods in this investigation.

3.3.2. THE RESEARCHER

The researcher held a position as a Learning Designer at the University of Auckland, including over the course of this research. Entering the study, the researcher possessed no direct professional background or prior involvement with the subject matter being examined, nor did they have existing professional connections with the stakeholders or participants involved in the research. As a foreigner conducting research in New Zealand, the researcher brought an outsider perspective, which enabled a unique vantage point for understanding disaster preparedness through the diverse cultural and social lenses present in the local context. However, this position also required careful reflection and sensitivity to ensure that local knowledge, customs, and experiences were respectfully integrated into the research process. As of the present, the researcher is not engaged in any professional capacity that aligns or intersects with the roles or responsibilities of the study's participants. This detachment from the participants' domain ensured an unbiased approach to the research process, allowing the researcher to navigate the study with an objective perspective, free from pre-existing biases or influences.

3.4. DATA COLLECTION AND ANALYSIS

This section presents the qualitative methodology of the study, detailing the use of thematic analysis via interviews and the innovative design probes developed for this research by employing a systematic approach to data analysis, the study ensures that findings are grounded in the data while also contributing to the broader realm of children's participation and involvement in DRR efforts.

3.4.1. STUDY POPULATION AND DATA COLLECTION

The study population for this research was selected to align with the objectives of exploring the impact of design probes on engaging children in DRR. The study population involves 26 children aged between 8 to 12 years. This age group is selected based on cognitive development theories, which suggest that children

within this range are at a crucial stage of cognitive and social development, enabling them to engage critically and creatively with educational content (Inhelder & Piaget, 1958). At this developmental stage, children begin to grasp abstract concepts, engage in perspective-taking, and develop problem-solving skills, making them well-suited for participatory learning approaches, such as design probes, in DRR education (Grabau, 2015; Sweller et al., 2011).

The gender distribution of the participants was balanced, with an effort to include a diverse range of socio-economic and cultural backgrounds to reflect Auckland's demographic diversity. Recruitment was carried out through schools and community organisations, with information sessions conducted to explain the study to children and their guardians. The selection criteria for participants included age, informed consent from guardians, and the children's availability and willingness to engage with the study over its duration. Children with prior experience in disaster education or personal exposure to disasters were not excluded, as their perspectives were deemed valuable in understanding varying levels of familiarity with DRR concepts.

Moreover, a randomised sampling strategy was employed to enhance the generalisability of the findings and minimise selection bias (Shadish et al., 2002). Randomisation ensures that all eligible participants have an equal chance of being selected, reducing the likelihood of over-representing specific demographic groups (Bryman, 2016). This approach is particularly relevant in studies involving educational interventions, where diverse perspectives contribute to a more comprehensive understanding of learning outcomes (Cohen et al., 2018). The essential criterion was that participants must reside in Auckland, New Zealand. This methodological choice diverges from purposive sampling to avoid bias towards any specific demographic or experiential background aside from geographical location.

Auckland was chosen due to its diverse population and the variety of disaster risks it faces, ranging from volcanic activity to flooding, making it a valid setting for studying DRR among children. By including children from different suburbs, the study ensured a mix of experiences, with some participants living in high-risk areas prone to flooding, while others had minimal exposure to natural hazards. This approach aimed to gather a broad spectrum of insights from children with varying degrees of familiarity and experience with local disaster risks, thus providing a well-rounded understanding of the efficacy of design probes in DRR education for this age group. Although the sample was demographically diverse, no strong or systematic differences in engagement with the probes were observed across age, gender, or background within this group. Instead, the activities appeared broadly accessible and adaptable, with the diversity of participants contributing mainly to a wider range of examples and stories rather than to clear differences in how the tool functioned.

The data collection process followed a structured three-phase process, adhering to the double diamond framework to facilitate a thorough exploration and understanding of the probes' impact. The initial phase involved pre-test online semi-structured interviews to evaluate the participants' baseline knowledge and perceptions of DRR. These interviews were conducted with children aged 8 to 12 years, recruited from Auckland, New Zealand, during the first half of 2023. Each interview session lasted approximately 10-15 minutes and was designed to establish the participants' existing knowledge of disaster preparedness, their personal or familial experiences with disasters, and their views on vulnerability and resilience. The semi-structured interview guide included both general and exploratory questions, such as: "What do you know about disasters?" and "How do you think people can prepare for them?" This phase also served to build rapport with participants and encourage engagement with the subsequent activities.

Following this, children interacted with the design probes over a two-week period before their completed probes were collected back by the researcher. The probes included tasks such as a reflective board game, diary entries, and a role-playing activity, each designed to elicit children's perceptions and creative engagement with DRR concepts. Instructions were provided for each activity, along with a narrative character named "Kit" to enhance engagement.

The final phase comprised post-test online semi-structured interviews aimed at evaluating any shifts in the participants' understanding, attitudes, and feelings towards DRR after engaging with the probes. These interviews included questions that mirrored the pre-test interviews (e.g., "What do you know about disasters?" and "How can people prepare for them?") to facilitate comparison. Additional questions were designed to explore participants' experiences with the probes, such as: "Which activity did you enjoy the most, and why?" and "Did the probes help you think differently about disasters?" This sequential approach allows for a comprehensive assessment of the probes' effectiveness in enhancing DRR education among the target age group, while also ensuring rich and meaningful engagement with the research themes.

3.4.2. ETHICS CONSIDERATIONS

This study obtained ethics approval for the sections of the research that include data from the participants (for interviews and gathering data using design probes) and was approved, designed, and implemented in accordance with the guidelines of the Auckland University of Technology Ethics Committee (AUTEC) (21/436) (Appendix 1)). Ethical considerations are paramount in research involving children. Measures were taken to ensure confidentiality, informed consent, and the right to withdraw without penalty.

3.4.3. INTERVIEWS

Interviews were analysed using a combination of reflexive and interpretive thematic analysis (Creswell, 2011) and the Framework Method (Ritchie et al., 2013a). An inductive-deductive method was adopted to confirm the conclusions

of the inductive phase, which also served as a starting point for the deductive phase. This approach allowed themes to emerge both from the reported experiences of participants engaging with design probes in Disaster Risk Reduction (DRR) for children and deductively from theories relevant to child engagement and learning within DRR contexts. The interpretive systemic framework, adapted from the principles outlined by Braun & Clarke (2012), incorporates an epistemological approach tailored to understanding the systemic integration of probe activities into children's learning processes. This approach interprets viewpoints arising from the diverse experiences of children interacting with the probes, guiding the sampling strategy to capture a wide array of perspectives on engagement and learning in DRR.

To recruit participants, multiple invitation posters were shared online and in person. Parents or guardians of the potential participants were then contacted via email or phone by the researcher to confirm their expression of interest in participating in the research project. They were then presented with the participant information sheet (Appendix 2) and consent and assent forms (Appendix 3) and were invited to the online interview session via Zoom. The consent and assent forms were collected at recruitment prior to participation.

The semi-structured interview guide contained an introduction of the interviewer and the project overview, followed by a few ice-breaker questions. designed to make the children feel comfortable and engaged. These included simple, conversational prompts such as, "What's your favourite activity or hobby?" and "Can you tell me about a fun day you recently had?" These questions helped to establish rapport and ease participants into the discussion, creating a relaxed environment for more in-depth conversations about disaster-related topics. The semi-structured interview included six subset questions directly addressing the study's research objectives. These questions were designed to explore the participants' baseline knowledge, perceptions, and experiences related to disasters and disaster preparedness. Examples of these questions included:

"What do you think a disaster is?" "Have you or your family ever experienced a disaster? If yes, what happened?" "What do you think people can do to stay safe during a disaster?" "Do you think children can help in preparing for disasters? How?" "What do you know about risks in your neighbourhood?" and "What do you think is the most important thing to do during an emergency?" These questions allowed participants to reflect on their understanding while providing insights into their initial perspectives and awareness of disaster-related concepts.

. The interview questions were designed to elicit participants' existing level of knowledge and experience with disasters and disaster preparedness concepts. The interview guide received feedback from academics and design research experts and was validated in the design process. After the introduction, the participants were asked to talk about their day or their favourite activities as ice-breaker questions. They were followed by basic yet general questions about disasters and the participants' or their families' experience with disasters, as well as their perspectives on vulnerability towards disasters. This pre-test interview also aimed to increase the participants' engagement with the project, resulting in more motivation to complete the probe activities later on. It has been brought up in the probe literature that participants' lack of motivation to complete the probes has been one of the recurring challenges (Hulkko et al., 2004b; Jarke & Gerhard, 2017b; Mattelmäki, 2005a). Therefore, including this pre-test interview in the research design, which aimed to create a friendly and relaxed environment for the participants, was one of the ways in which this study aims to tackle that particular challenge.

Following that phase, after the participants interaction with the probes were completed, they were invited to the second online (post-test) interview. The purpose of this interview was threefold: To evaluate the participants' experience with the probes, to explore the impact of the probes on participants' understanding of disasters and disaster preparedness, and to clarify any potentially unclear answers they may have provided to the probe activities. To

approach the abovementioned points, this interview followed a similar structure to the previous one, and it also included some of the same questions as the pre-test interview in order to compare participants' answers to be able to explore the impact of the probe activities on the participants.

3.4.4. STUDY INSTRUMENTS: DESIGN PROBES

In this study, design probes serve as an essential instrument to facilitate the engagement and involvement of children in DRR themes. The probes were carefully designed based on literature and pilot testing to ensure they were age-appropriate, engaging, and effective in eliciting meaningful data. A key feature of this study is its evolutionary approach to the development of design probes, where the iterative refinement of these tools played a central role in their effectiveness. Rather than relying on a fixed set of instruments, the study embraced an adaptive process, incorporating insights from pilot testing and ongoing feedback to refine the design and improve engagement. This careful design process, informed by the voices of participants in multiple stages of iterations, contributes to the scientific robustness of the study. This careful design process contributes to the scientific robustness of the study.

Design probes are built on the participatory design principle, which emphasises the importance of involving users in the design process, ensuring outcomes are both relevant and empowering (Sanders & Stappers, 2008). By refining the probes throughout the study, the activities became better aligned with children's cognitive abilities and interests, helping them engage more meaningfully with disaster preparedness concepts. This methodology aligns with the study's objectives to engage children in DRR by valuing their insights and creative contributions.

Design probes are crafted to be open-ended and adaptable, encouraging participants to express their thoughts and ideas freely and creatively, thus generating rich and informative data (Mattelmäki, 2005a). The probes used in

this study were designed to appeal to the developmental and cognitive capabilities of children aged 8 to 12 years. They included a mix of materials and tasks such as a diary, a role-playing game, a reflective board game, and a time capsule activity. Each was chosen for its potential to engage children deeply with the concepts of disasters and preparedness, facilitating reflection, discussion, and creative expression. As the study progressed, tweaks were made based on feedback, adjusting instructions, modifying activities, and ensuring that every probe encouraged deeper thinking and reflection in an engaging and effective manner.

Children were given instructions on using the probes but were encouraged to interact with them in a manner that was natural and enjoyable to them. This ensured that the collected data was reflective of the children's genuine perspectives and creative processes. Moreover, to improve children's engagement, a character called "kit" was created to provide a narrative, guiding children through each activity and occasionally providing examples of how some of the activities could be done. "Kit" was not part of the original design but was introduced after early testing showed that children responded better when they had a friendly guide. Adding this character made the activities more immersive and relatable, encouraging deeper participation. The decision to introduce this character was informed and inspired by the key role storytelling elements can play in improving motivation and engagement in participants (Khatami & Ghahremani, 2014; Milojević & Izgarjan, 2014). The flexible engagement allowed children to explore the probes at their own pace and in their own environments, catering to their varied schedules and ensuring the engagement was perceived as a meaningful activity rather than a task.

3.4.5. THEMATIC ANALYSIS

Theme Analysis (TA) is an essential tool for identifying, exploring, and interpreting the emerging patterns or themes in qualitative research (Braun & Clarke, 2019a). Its main strength lies in its adaptability, free from the constraints

of rigid theoretical models, which allows for its application across diverse theoretical orientations (Braun & Clarke, 2012). This adaptability facilitates a seamless integration of both (post)positivist and constructivist approaches (Ritchie et al., 2013b). TA is celebrated for its capacity to distil complex data into comprehensible themes that reveal both the overt and covert aspects, thereby shedding light on the cognitive and symbolic facets of a given phenomenon.

In conducting TA, researchers engage in detailed scrutiny of the data to develop initial codes, which lay the groundwork for the identification of broader themes (Braun & Clarke, 2019a). These themes are not simply summaries but are organised around a central concept, providing a framework for the researcher to articulate their analytical observations. This approach aims to expose both the manifest and latent content within the data, offering a rich understanding of the subject being studied (Braun & Clarke, 2012). TA's adaptability is further evidenced by its applicability to various research settings, methodologies for data collection, and its capability to handle different volumes of data and participant diversity. Particularly valuable in studies that seek to explore new areas, TA supports both inductive and deductive methods of investigation, proving to be an essential tool for examining the intricacies of human experiences and social phenomena. This adaptability is bolstered by rigorous quality assurance measures, including a two-tier review process to ensure the reliability and validity of the thematic outcomes.

Furthermore, TA's methodological agility is balanced with a dedication to analytical depth, to ensure the integrity of the thematic conclusions (Denzin & Lincoln, 2011). This balance between flexibility and meticulousness, along with its user-friendliness for researchers at varying levels of expertise, makes TA an indispensable instrument in qualitative inquiry. It provides a systematic yet adaptable approach to uncovering the deep-seated meanings within qualitative data, facilitating a comprehensive understanding of the subject matter. Its potential for cross-disciplinary use is significant, with practitioners in fields

ranging from psychology to sociology and even extending into areas such as design and media studies appreciating TA for its effectiveness in converting complex qualitative data into understandable, practical insights. This broad applicability highlights TA's role not just as an academic instrument but as a bridge connecting various disciplines through a shared goal of deciphering human cognition and social interactions (Braun & Clarke, 2012). TA encourages researchers to engage with the data reflectively, prompting them to consider not only the explicit statements but also the wider contexts and implied meanings.

3.4.5.1. TYPES AND PROCEDURES OF THEMATIC ANALYSIS

Thematic Analysis (TA) encompasses a range of methodological approaches rather than a singular standardised method, which are characterised by diverse practices and philosophical underpinnings, notably including reflexive thematic analysis and interpretive thematic analysis. Each variant contributes unique methodologies and insights to the studies they underpin (Braun & Clarke, 2021).

Reflexive Thematic Analysis (RTA) centres the researcher within the analytical process. This approach underscores the pivotal and contemplative role of the researcher in theme identification and analysis (Maguire & Delahunt, 2017). RTA views theme development as a dynamic, iterative engagement, necessitating a perpetual cycle of familiarisation with data, coding, theme identification, and revision. This process is inherently cyclical, necessitating a continuous swinging between data, codes, and emerging themes, leveraging the researcher's subjectivity as an asset for in-depth and nuanced data interaction. In contrast, Interpretive Thematic Analysis (ITA) maintains a focus on pattern identification within data but leans significantly on hermeneutic philosophies. These philosophies endorse the interpretation of deeper meanings and contexts that inform the superficial data content (Braun & Clarke, 2019b, 2019a, 2021; Clarke & Braun, 2013, 2017), aiming to not only discern themes but also comprehend

their broader implications and meanings within the human experience narrative (Kennedy, 2018).

An additional facet of thematic analysis involves the suite of inferential strategies employed to interpret data and create meaning. The literature describes a spectrum of logical frameworks or inferential approaches, including but not limited to inductive, deductive, abductive, analogical, hypothetico-deductive, intuitive, and critical reasoning (Braun & Clarke, 2021; Clarke & Braun, 2017; Maguire & Delahunt, 2017). These strategies delineate various methodologies through which data can be approached, arguments constructed, and theories formulated or expanded upon. Notably, inductive and deductive reasoning stands out as prevalent strategies within the thematic analysis, facilitating the validation of conclusions drawn from the data (Seel, 2012). Inductive reasoning, as explained by Kennedy (2018), is a bottom-up, data-driven approach that builds theories from detailed observations, whereas deductive reasoning adopts a top-down strategy, testing theories or hypotheses against observed data to affirm or refute pre-existing notions (Braun & Clarke, 2019b; Seel, 2012).

This study adopts a hybrid inductive-deductive method, integrating both reflexive and interpretive thematic analysis. Thematic analysis was applied to both the pre-test and post-test interviews (n=40, 20 pre-test and 20 post-test interviews) and the creative outputs from the design probes. The interviews provided rich textual data capturing participants' evolving understanding of disaster risk reduction (DRR), while the probes offered visual and narrative insights into their perceptions and creative engagements. This approach not only facilitates a thorough comprehension of the data but also introduces the flexibility to venture into previously unexplored areas and refine theories or hypotheses as dictated by the data (Braun & Clarke, 2019b; Seel, 2012). Furthermore, the deductive component of this methodological amalgamation lends additional credibility to the inductive findings, thereby enhancing the overall robustness of the results (Maguire & Delahunt, 2017; Proudfoot, 2023). As

delineated in Figure 10, the primary stages of thematic analysis in this study employing an inductive-deductive framework are outlined as follows (Proudfoot, 2023):

- A. **Data Familiarisation:** This initial stage is critical for engagement with the data by systematically reading and re-reading the material, whether transcripts, notes, or other qualitative data forms. This is the stage where inductive reasoning starts to take shape as patterns and ideas emerge from the data itself, without preconceived notions (Clarke & Braun, 2013; Maguire & Delahunt, 2017; Proudfoot, 2023).
- B. **Generating Initial Codes:** Through a reflexive approach, analysts systematically identify features of the data that are relevant to the research question. This process is iterative, with codes being refined as new insights are gained. Both inductive elements, where codes stem directly from the data, and deductive elements, where codes are influenced by existing theories or other frameworks, are used.
- C. **Searching for Themes:** The interpretive dimension of thematic analysis becomes pronounced as analysts integrate codes into potential themes. This entails both the generation of new themes from codes (inductive) and the alignment of these emerging themes with the theoretical framework guiding the analysis (deductive).
- D. **Reviewing Themes:** At this stage, themes are examined and contrasted with the data to verify their accurate representation, necessitating reflexivity as researchers evaluate their interpretations and their impact on the analysis. Themes may be merged, subdivided, or discarded following this iterative review.
- E. **Defining and Naming Themes:** This interpretive phase involves collating the essence of each theme, articulating clear definitions, and assigning concise, informative names. The synthesis of inductive and deductive elements persists as the empirical data and the applied theoretical narrative inform themes.

F. **Writing the Report:** The final step is to conclude the analytical work into a coherent and compelling report. This involves a reflexive and interpretive recounting of the themes, illustrating how they relate to the broader theoretical framework and the research question. The report must convey the complexities and nuances of the data while demonstrating a rigorous analytical process.

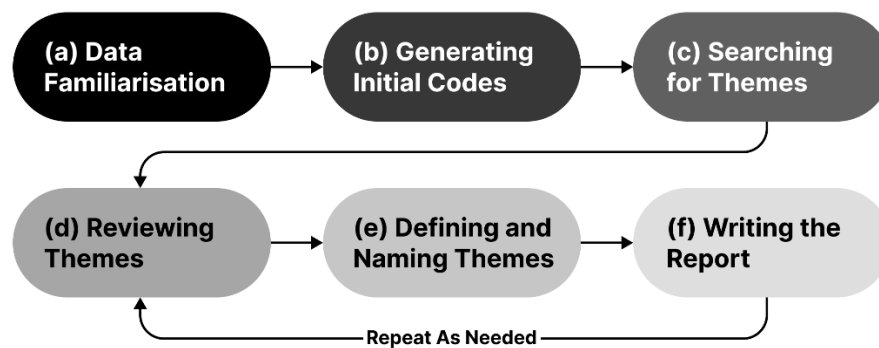


Figure 10. Primary components of thematic analysis.

3.4.5.2. SENTIMENT ANALYSIS

Sentiment analysis refers to the systematic identification and categorisation of attitudes, opinions, or emotions expressed in textual data, typically classified as positive, negative, or neutral (Liu, 2012). Although sentiment analysis has its origins in computational linguistics, within qualitative research, it serves as a valuable method for exploring the affective dimensions of participants' narratives. This method was selected because it enabled an in-depth understanding of the emotional responses participants had toward the art and design intervention, enriching thematic interpretations and highlighting emotional nuances that might not be immediately evident through content analysis alone.

In this study, sentiment analysis was conducted using NVivo's automated sentiment coding functionality, which assigns each textual segment to one of four sentiment categories: very positive, moderately positive, moderately negative, and very negative. NVivo employs a built-in sentiment lexicon designed specifically for qualitative research contexts, making it suitable for capturing the emotional tone in participant narratives. However, automated sentiment analysis tools can struggle with context-sensitive linguistic nuances, such as irony, sarcasm, or ambiguous emotional expressions. Therefore, an additional step was undertaken to ensure accuracy and context sensitivity. The researcher manually reviewed and refined the automated sentiment coding, correcting any misclassifications or errors resulting from algorithm limitations. This step was crucial in capturing the nuances in participants' responses and ensuring the sentiment labels accurately reflected their intended meanings.

3.4.5.3. SEMANTIC ANALYSIS

Semantic analysis in qualitative research focuses on identifying explicit meanings and themes from participants' responses, aiming to describe their experiences and perceptions directly from the expressed content rather than exploring deeper underlying meanings (Braun & Clarke, 2006). This method was specifically chosen because it allows researchers to stay close to participants' original narratives, providing an authentic representation of their experiences. Given the nature of this research, where individual perceptions and experiences with an intervention were central, a semantic analysis was most suitable.

Semantic analysis began with an open coding stage, performed line-by-line within NVivo. This initial coding was intentionally inclusive and exploratory, assigning descriptive labels to significant segments of text and capturing emergent concepts such as usability concerns, emotional responses, creative engagement, and design appreciation. To improve accuracy and depth, NVivo's text query tools, such as word frequency and text search queries, were used together with manual coding to spot recurring or possibly missed ideas. This

combined approach made sure that the analysis captured concepts thoroughly and reliably.

3.5. CHAPTER SUMMARY

This chapter outlines the methodological approach adopted in this study, focusing on adopting design probes to enhance the creative participation of children in DRR. In the current landscape, methodological approaches to children's participation in DRR remain limited, with most studies relying on conventional, adult-centred methods that constrain children's agency. Additionally, recognising the unpredictable nature of disasters, the research highlights the urgency of incorporating children's perspectives and creative contributions to build resilient communities. It emphasises an innovative methodology that seeks to amplify the imaginative voices of children, encouraging them to explore and better understand disasters and disaster risks. In doing so, it builds on emerging strengths in the field, particularly growing evidence that creative, participatory engagements can deepen children's understanding and foster resilience.

Yet persistent shortcomings remain. Participation is still frequently tokenistic, and there is a lack of methodological tools designed to elicit children's imaginative and creative ways of knowing and learning. Taken together, these patterns highlight the need to move beyond informational or compliance-oriented activities toward approaches that centre children's agency, creativity, and ownership. This approach presents an untapped potential in recognising and harnessing children's unique insights towards creating resilient futures, thus ensuring their ideas and innovations significantly influence disaster preparedness initiatives.

The methodology integrates a mixed-method approach, combining qualitative inquiries with design-led investigations to merge theoretical efforts with creative exploration. This interdisciplinary approach bridges the gap between theoretical

knowledge and practical application, aiming to generate outcomes that are both academically significant and tangibly beneficial in real-world scenarios. Design probes serve as a central methodological tool, acting as catalysts to elicit rich insights into children's perceptions and creative engagements with disaster preparedness. Through detailed articulation of research design and methodology, the chapter investigates research paradigms, design and goals, qualitative research approaches, data analysis, study population, data collection methods, ethical considerations, and the integration of interviews and thematic analysis, along with design probes.

By clarifying these methodological choices, the chapter signals a shift toward a more child-centred, imaginative, and participatory DRR methodology that supports deeper forms of engagement and positions children as genuine contributors to future resilience-building strategies. Taken together, these elements set the foundation for understanding how the study aims to contribute to the field of DRR by actively involving children in the learning and discovery process about disaster preparedness, and by framing them as crucial agents in shaping how communities prepare for and respond to disasters.



"Form follows function.."
- **Louis Sullivan**

CHAPTER 4 – EVOLUTION OF KIT

4.1. CHAPTER INTRODUCTION

“Good design is actually a lot harder to notice than poor design, in part because good design fits our needs so well that the design is invisible” – Dan Norman

This chapter presents the evolutionary design process of the set of probes applied in this study with the goal of promoting children’s creative participation and engagement in DRR. The primary objective of this chapter is to document and analyse the iterative development of the Kit, showcasing how it was designed to address a critical gap in disaster risk reduction, especially the absence of participatory and child-focused tools that simultaneously engage children's creativity, agency, and understanding of disaster risks. By blending design frameworks and DRR principles, the Kit contributes to closing this gap by offering a methodologically sound, interdisciplinary approach tailored to children’s unique needs and perspectives. The creation of the set of probes, referred to as “Kit”, is an interdisciplinary contribution of the study, drawing upon design frameworks that help guide the design process and taking DRR principles into account with a focus on children’s agency.

An iterative process was applied to achieve the overall design of both aesthetics and materials, as well as the activities created for this study. Following the double-diamond framework, each phase of the design was carefully explored, prototyped, and tested in multiple rounds to arrive at the finalised configuration. This chapter draws upon two primary data sources: participant feedback gathered through qualitative methods during iterative testing and insights from the relevant literature. Participant feedback, specifically from children in the target age group, provided essential user-centred insights that shaped the refinement of the probes, while theoretical frameworks ensured alignment with established practices in design and disaster education. Each iteration of the prototype design and testing involved thorough research, with each activity

choice being informed by a review of relevant literature. This ensured that the designs were grounded in established theories and practices within both design and DRR domains. Furthermore, participant input and engagement played a critical role in refining the activities at every step of the process. In each iteration, the feedback gathered from participants was incorporated into subsequent versions, resulting in continual improvements and revisions for the upcoming iterations.

4.2. FINDING THE RIGHT TOOLS: DESIGN PROBES

From the very early stages of the study, and even prior to establishing the definitive study design, the adaptation of design probes as the main means of data collection was identified as a strategic decision. Design probes are infinitely customisable and provide a more direct and immersive connection to the users' daily lives and experiences (Gaver et al., 1999a; Graham et al., 2007b). These qualities make design probes a great means of engaging children in the context of DRR. This decision is grounded in several contemporary frameworks and methodologies that bring attention to the importance of participatory design in education and DRR. Participatory design, as discussed in Light, A., & Akama, Y. (2014) highlights the significance of user involvement as co-designers, ensuring that tools like design probes are inspired and informed by the end-users themselves. This aligns with the latest insights on co-design methods in educational research, particularly those involving vulnerable populations such as children such as children, within educational and disaster preparedness contexts (Bergold & Thomas, 2012).

Additionally, the Community-Based Participatory Research (CBPR) model, which has continued to evolve in recent years Wallerstein et al. (Wallerstein et al., 2017), emphasises the active involvement of community members in shaping research interventions. This approach has been critical in disaster preparedness education, where involving children as active participants increases the relevance and effectiveness of educational interventions. The integration of

CBPR principles into this study justifies the decision to use design probes, as they facilitate active engagement and reflective participation.

Primarily, in the exploration phase of the study, multiple design methods and tools were examined as potential means of data collection and engagement approaches, including interviews and participatory design workshops. Additionally, user diaries and scenario-based designs were considered to gain deeper insights into user behaviours and preferences. Techniques such as card sorting, photo elicitation, question prompting, and mapping activities were also explored in the form of early-stage prototypes. Figure 11 shows a snippet of this exploration phase by illustrating the activity mapping and brainstorming.

Ultimately, design probes were the superior choice given the particular goals and intentions of this study, as they provided a more direct and immersive connection to the users' perspectives. This selection aligns with Bødker's (2015) update to participatory design theories, which stress the need for tools that allow users to articulate their experiences and values in complex social contexts. The concept of reflective practices, as highlighted in Schön's (2008) works, reinforces the importance of creating reflective spaces for children to think critically about disaster risks and preparedness.

Design probes serve as mechanisms for reflection, making them not only data collection tools but also educational tools that foster deeper engagement and critical thinking. Each activity choice for the probes in this study was informed by a review of relevant literature and further refined based on participant input and engagement. Design probes offer the opportunity to explore participants' viewpoints and, as a result, collect their input on the designs. When thoughtfully designed, they can be instrumental in eliciting deep, meaningful insights, making them the perfect fit for this study, given this study's specific dimensions and goals.

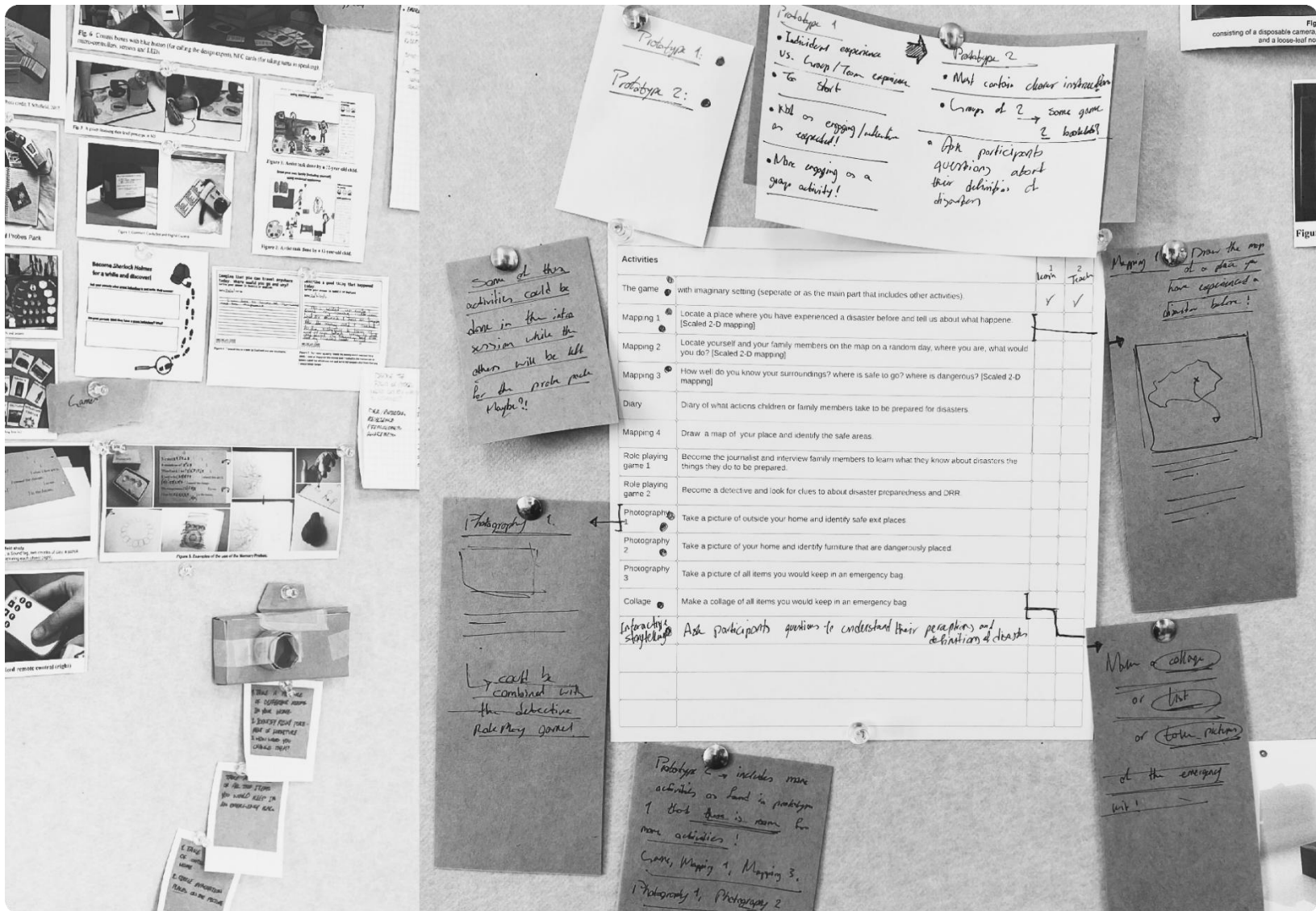


Figure 11. Exploration and examination of different activities, tools, and methods to be applied to the study design.

One central focus of the study was also to bring out the voices of the children and explore their viewpoints within the context of DRR. The aim to inspire children to acknowledge their own agency and provide their reflections on this topic allowed for an exploration of their existing knowledge and experiences with disasters and their motivation to further learn and deepen their understanding of disaster preparedness measures. This approach aligns with Vygotsky's social constructivist theory as applied in contemporary educational contexts (Kozulin, 2022). Design probes provide opportunities for children to construct knowledge collaboratively and contextually, deepening their understanding of disaster risks through social interaction. Moreover, sitting at the intersection of educational and participatory approaches, this research seeks to guide participants towards a pathway of discovery about disasters and disaster risks, as opposed to delivering direct instructions on specific actions to be taken in time of a disaster. This educational approach is supported by recent studies in experiential learning, including Kolb and Kolb (2017) which emphasise the importance of connecting learning to real-world experiences. Design probes, through immersing children in disaster-related scenarios, can enable experiential learning and make the content more relatable and impactful. This educational approach, rather than a purely instructive one, renders the study innovative by aiming towards the creation of a more memorable experience, which, consequently, has a greater impact on participants' motivation and engagement in DRR contexts.

The selection of design probes for their potential, especially in enhancing engagement and participatory involvement, is supported by existing scholarly literature that emphasises their adaptability and effectiveness. The concept of design probes was introduced by Gaver et al. (1999). As a means of inspiring design through exploring users' lives and experiences, which resonates with the objective of capturing children's viewpoints on disasters. Additionally, the focus on participatory design, advocating for developing tools and methods in collaboration with children, aligns with the growing advocacy for more inclusive

approaches in disaster preparedness education highlighted by Plaisant et al. (2002) and Hart (1992). This participatory approach is also aligned with critical pedagogy, as outlined by Freire (2020), where learners (children) are positioned as co-creators of knowledge, empowering them to take proactive roles in DRR.

4.2.1. FROM INITIAL PROTOTYPES TO THE EUREKA MOMENT

The initial phase of the design process began with a clear definition of the research objectives and an assessment of the potential tools and resources required to meet these goals. This foundational step involved a thorough review of existing literature on design probes, alongside a review of innovative and participatory approaches applied in the DRR realm, and then further exploration of the literature on engaging children within the DRR framework. Design probe methodologies, as discussed by Boehner et al. (2012) and Gaver et al. (1999), are rooted in user engagement and experiential exploration, allowing for the collection of rich qualitative data through interaction and reflection. These methodologies have been particularly effective in uncovering users' subjective experiences and fostering deeper participation (Graham et al., 2007b).

With the theoretical foundation set upon these design probe methodologies, combined with disaster risk reduction (DRR) frameworks such as the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015), the focus on children's agency and creative exploration in disaster preparedness became clear. Research has shown that empowering children as active agents in disaster preparedness increases their sense of ownership and resilience (Mitchell et al., 2008; Peek et al., 2018). In this study, this is achieved through developing activities that enhance children's knowledge of disaster risks, provide a platform for dialogue with peers and parents, and foster their creative problem-solving skills through participatory engagement. Within the context and dimensions of this study, empowerment is defined as enabling children to actively contribute their ideas, reflect on their experiences, and develop a sense of agency in understanding (Haynes & Tanner, 2015a) risks (Haynes & Tanner, 2015a).

Furthermore, Peek (2008) highlights children's physical and psychological vulnerabilities and unique potential for fostering resilience in disaster contexts despite these vulnerabilities, which were also key in informing the integration of activities that aim to enable children to actively participate in DRR efforts.

To this end, an exhaustive list of potential activities was curated, considering a range of interactive elements that have been traditionally used in probe studies, from maps and games to diaries, aligning with established probe design practices. The chosen activities were then prototyped in a variety of sequences and configurations, aiming to refine the probe kit through iterative design and user feedback and input. This process included soliciting feedback from a diverse group of individuals, primarily university students and academic peers from the AUT campus, who were invited to interact with the prototypes in structured sessions. These sessions focused on evaluating the prototypes' engagement levels, clarity of instructions, and alignment with the study's objectives. Feedback was collected through informal discussions, observation notes, and participant reflections, which were then analysed to inform subsequent design iterations. This iterative design process involves continuous cycles of testing, feedback, and refinement, which helps ensure that the tools are progressively refined to better address the needs and goals of the target group of participants. This method was applied throughout the study and in multiple cycles, as described further throughout the chapter (Zimmerman et al. (2007a).

In line with research on gamification and playfulness in education, studies like McGonigal (2011) which highlights the motivational power of games in promoting problem-solving and collaboration, and Prensky (2003), emphasising the educational benefits of game-based learning in enhancing cognitive engagement, support the idea that incorporating game-like elements enhances the overall engagement and learning outcomes. Subsequently, early in the design and prototyping process, it became clear that incorporating playfulness

and gamification held great potential to increase participant engagement. Building on this insight, a narrative-driven character was developed, drawing on research that demonstrates how empathy in design fosters deeper participant engagement and understanding (Wright & McCarthy, 2008). The character, designed to be culturally and contextually neutral to avoid bias and simultaneously leave open space for participants' interpretations, took the form of an alien named 'X', who seeks the participants' assistance in learning about disaster preparedness and resilience. This approach reflects narrative engagement theories in learning and engagement, where narrative elements help participants emotionally connect with the content, making the learning and discovery experience more effective, relatable, and memorable (J. Bruner, 1991; Giaccardi & Karana, 2015a).

The game mechanics were structured around four key spaces, each designed to engage participants in familiar, everyday environments. First, participants were prompted to decorate these spaces using pre-designed game pieces. Next, they were encouraged to imagine disaster scenarios and propose potential solutions. These spaces were carefully chosen to reflect common settings that participants in this age group could relate to, including the character's home, their school or classroom, an outdoor environment, and a customisable space where participants could define and personalise the setting (McGonigal, 2011; Prensky, 2003). According to the works of game designers and researchers such as McGonigal (2011), creation of immersive environments encourage creativity and problem-solving by placing participants in realistic, yet imaginative situations which is also highly aligned with disaster preparedness goals and efforts.

As suggested by Giaccardi et al. (Giaccardi & Karana, 2015a), tactile interaction with physical elements enhances cognitive engagement by allowing participants to physically manipulate and explore objects. With this in mind, throughout the study, I paid special attention to the materials chosen, both in terms of aesthetics

and quality, across all prototypes and iterations of the probe kits of this study. The character 'X' as part of the preliminary prototypes, along with the associated game pieces, was brought to life through a blend of 3D printing, clay modelling, and laser-cutting techniques, ensuring a tactile and visually engaging experience for participants. These efforts, aimed at creating a high-quality and engaging design, were critical in maintaining participant interest and involvement (Giaccardi & Karana, 2015b). Accompanying the physical components was a booklet that outlined several activities and introduced the character's backstory, serving as a guide through the learning journey. Figure 12 illustrates the initial prototype of the game pieces, including the character and its surrounding environment.

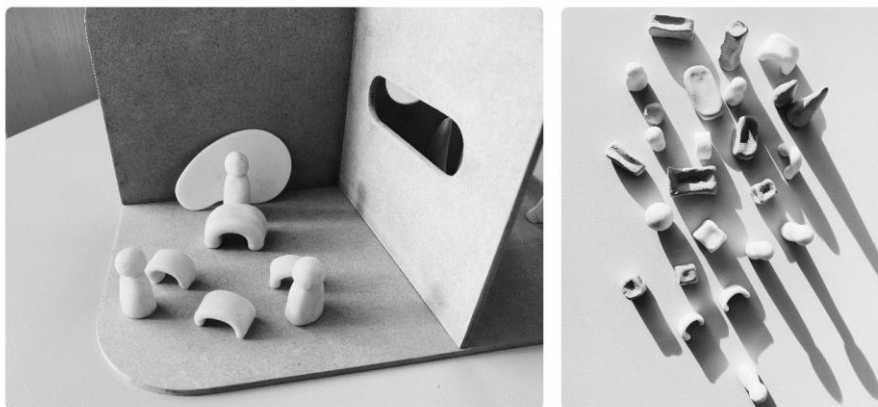


Figure 12. Initial creations of the characters and game pieces

Further refinement of the probe design was pursued through additional rounds of user testing, incorporating feedback and insights from a broader audience of university students and PhD peers within the field of design. Despite these efforts, there was a realisation that the probes, in this shape and form, had not yet achieved their full potential in facilitating a deep exploration of participants' views on DRR or initiating deeper thinking and learning of DRR concepts. This led to a comprehensive re-evaluation and redesign of the activities, following the iterative nature of design research where each phase builds on the learnings

of the previous one (Zimmerman et al., 2007). A key takeaway from the mentioned phase in the design process was the recognition of the fictional character 'X's effectiveness in addressing several challenges simultaneously, including participant motivation, fostering empathy and emotional connection, and ensuring clarity throughout the activities to avoid confusion. Narrative-based design, as explained by Wright & McCarthy (2010), fosters empathy and motivation by giving participants a relatable figure to help, which in turn encourages more thoughtful engagement with the content. The character facilitated a deeper narrative engagement, motivating participants to contribute more actively to 'helping' the character navigate disaster preparedness scenarios. This approach significantly enhanced user engagement and motivation and provided a structured pathway through the activities, illustrating the multifaceted benefits of incorporating narrative elements and empathy in educational design. Figure 13 shows a more polished version of the game, along with some examples of the pages from the booklet.

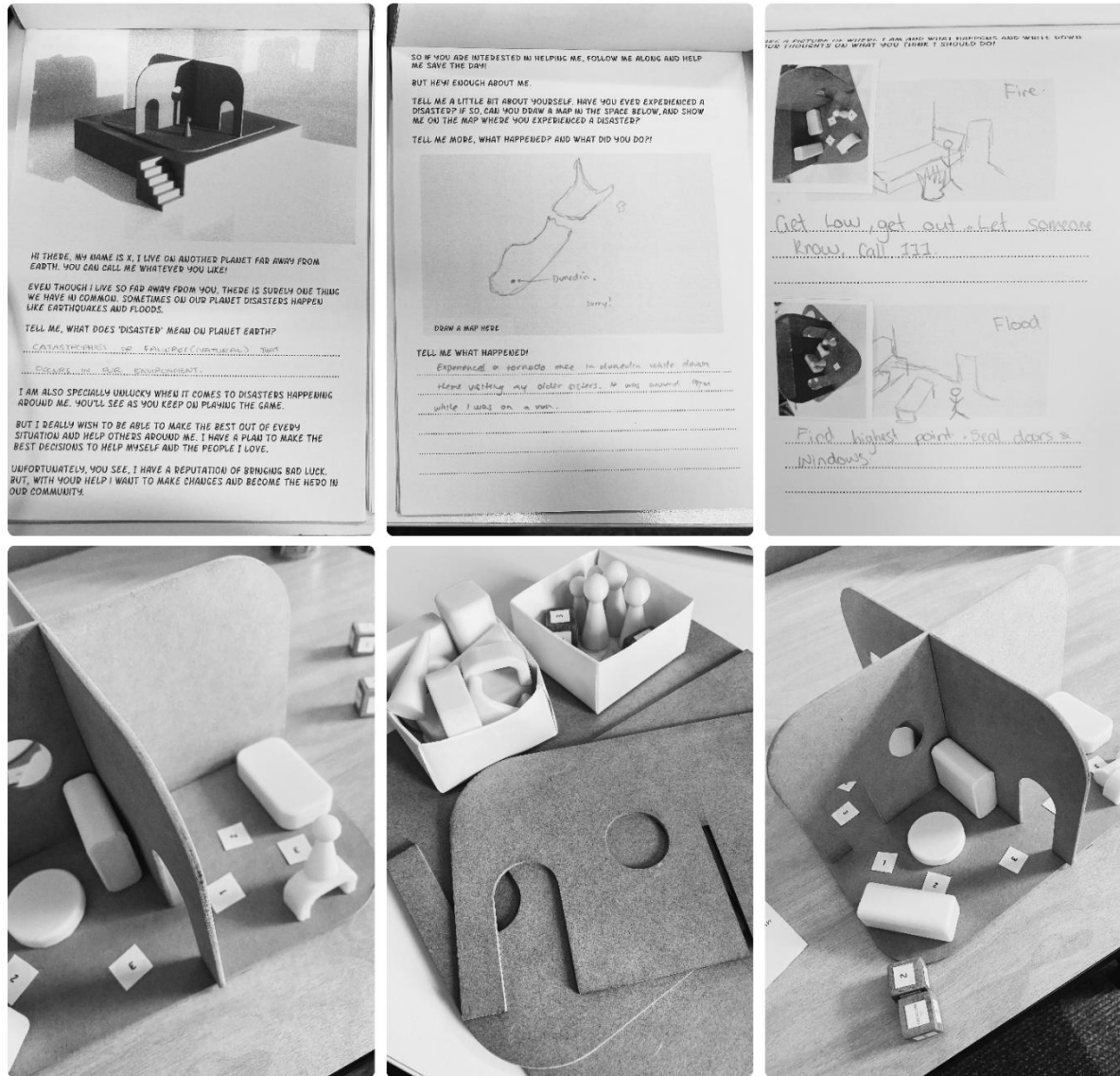


Figure 13. Booklet first trials, along with game pieces.

The main takeaway from this part of the design process was realising the importance and impact of integrating a fictional character, highlighting the great potential of narrative and playfulness in this context. And with that, this prototype called Probe V.1 marked the beginning of the design journey in this project.

4.2.2. KIT WAS BORN

In the evolution of the designs, the transition to the following phase started with a shift in the design, integrating lessons learned from the previous version and bringing us to the next version of the probe kits, Probe V.2. This shift involved a foundational re-evaluation of the probe activities, by a critical examination of the underlying reasons (the 'why') for the selection of specific activities and a detailed analysis of the design strategies (the 'how') employed to ensure alignment with the overarching research objectives. This analytical approach led to the development of a refined probe set characterised by a broader incorporation of playful and gamified elements, moving beyond the initial reliance on a singular game narrative and an alien character motif.

Moreover, a key difference in this stage of testing was the inclusion of participants within the target age group of 8 to 12 years, whereas earlier prototype testing was conducted with university students and PhD peers to refine the initial design configuration. Engaging the actual target audience in testing is critical, as user-centred design frameworks emphasise that authentic insights come from engaging the end users themselves (E. B.-N. Sanders & Stappers Pieter Jan, 2008). By the time testing shifted to the intended age group, the design had become more defined, requiring only minor adjustments. Consequently, testing was carried out with smaller groups of two participants at a time, allowing for more focused observations and refinements.

Inspired by the character narrative in the previous probe version, a key element in this new design phase was the creation of 'Kit', a character conceptualised to

resonate with the thematic essence of a design probe kit, designed to embody the principles of neutrality and inclusivity in terms of gender, race, and other identifiers. This was key in making sure that all participants feel equally comfortable engaging with the character, which was achieved through designing the character with abstract and non-specific features, avoiding culturally or socially specific markers that could exclude any group. Character design, especially in educational tools and settings, benefits from being neutral and flexible to allow children to project their own identities and preferences, fostering a deeper empathic engagement (Walz, 2010). The choice of the name 'Kit' was also strategic; inspired by the term 'probe kit', the name invited a range of interpretations from participants and, in doing so, aimed to enrich the interactive experience and foster a deeper level of empathy and engagement with the probe activities. This character design was intended to serve as a presenter for the narrative, adaptable to the diverse perceptions and imaginations of the participants and to provide additional guidance for participants across the activities. This design strategy of using open-ended characters is informed by research on symbolic and abstract character design, which suggests that such designs invite a broader range of interpretations and enhance user interaction (Ishii et al., 2012; Klopfer et al., 2009).

The revised set of probes introduced a suite of four activities. These activities were designed to progressively deepen participant engagement, beginning with an icebreaker activity that eased participants into the exploration process, and then, further jumping in tasks that prompted more profound reflection and exploration. The initial activity, a diary exercise, which drew inspiration from established probe methodologies, encouraging participants to document and reflect on their daily routines and activities. The use of diaries and self-reporting methods in research involving children is supported by literature on participatory design, as it allows participants to reflect on their experiences in an unconstrained manner, providing valuable insights into their daily lives and environments (Gaver et al., 1999a; Mattelmäki, 2006a). This exercise aimed not only to provide insights into participants' daily lives but also to serve as a gateway to understanding their

awareness of disaster risks, family dynamics, and potential resilience strategies at the household level.

Building on the foundation laid by the initial activity, the subsequent exercise introduced participants to a role-playing game designed to foster an active engagement with disaster risk identification and family discussions on disaster preparedness.

Role-playing is widely recognised as an effective educational tool in both disaster education and participatory design, encouraging participants to simulate real-life situations in a safe and controlled environment (Dieleman & Huisingh, 2006; Shaw & Kobayashi, 2001). Additionally, research has shown that role-playing games are particularly effective in initiating reflective thinking in imaginary scenarios, allowing participants to explore complex issues from multiple perspectives (Kolko, 2010; Schon, 2008). This method has also been effectively used in probe studies such as (Bernhaupt et al., 2007b; Rodríguez et al., 2020b), where participants were encouraged to role-play different scenarios to elicit deeper emotional and reflective responses. Moreover, in the context of this study, the activity was structured to promote dialogue and collective problem-solving within families, thereby contributing to the strengthening of resilience strategies at the household level.

The final activity of Probe V.2 was inspired by the concept of memory probes, which aimed to delve into participants' perceptions and emotional connections to disasters through the exploration of their cherished objects (Petrelli et al., 2009). Memory probes are particularly useful in participatory design as they elicit emotional and personal responses, providing a deeper understanding of participants' values and attachments to physical objects and their relation to broader concepts like disaster risk (Petrelli et al., 2008). This activity was designed to prompt thoughtful reflection on the time-based evolution of these objects and their significance in the context of disaster scenarios, stimulating participants'

imaginings regarding the future and their place within it (Petrelli et al., 2009). This activity sought to discover participant perspectives on disaster awareness and preparedness, offering valuable insights into how participants envision and relate to the concept of resilience now and looking into the future.

Despite the advancements made with Probe V.2, the prototype testing process revealed several areas in need of refinement, ranging from minor typographical errors to more substantive issues, such as ambiguous questions and activity that proved confusing for participants. These improvements were aimed at enhancing participants' learning, increasing their awareness of disaster risks, and ensuring the activities were engaging and enjoyable. These challenges called for ongoing evaluation and adaptation in the design process, highlighting the need for continued iteration to enhance clarity, engagement, and the overall effectiveness of the probes in eliciting meaningful insights that circle back to the study goals and objectives. As a result, taking the insights gathered from this round along with participant feedback and input, I began to revise the design, drawing further inspiration from research studies conducted in similar contexts.

4.3 VOICES TO VICTORY: SHAPING KIT THROUGH PARTICIPANT INSIGHTS

In the iterative development of Probe V.2, a careful evaluation and analysis of the captured answers and insights from the participants revealed several critical areas for improvement, calling for a rethink and redesign of the activities to better meet the study's objectives more specifically, bring more focus to the context of DRR. This process uncovered three primary challenges that required reflection and problem-solving. These challenges and how they were addressed are as follows:

- 1. Diary Activity Enhancement:** Initially, the diary activity offered valuable insights into participants' daily routines but lacked a direct connection to DRR themes. To bridge this gap, the activity was redesigned to incorporate emoji stickers, allowing participants to annotate their daily activities with emotional cues, enhancing expressive documentation and reflection. This

method draws on the effectiveness of visual aids in fostering communication and engagement (Mattelmäki, 2006a). Additionally, guided examples from the character 'Kit' were integrated, encouraging participants to examine their environments and surroundings for potential disaster risks, fostering a proactive mindset towards disaster preparedness. This approach aimed to encourage reflective thinking about daily spaces and routines in the context of DRR, reflecting educational principles that promote critical observation and reflection (Azmi & Abdul Razak, 2015b; Graham et al., 2007a).

- 2. Memory Probe Activity Revision:** the initial deployment of the memory probe activity indicated a disconnection between the participants' comprehension and the activity's objectives. To address this, the activity was restructured to include clear introductory questions and narratives from 'Kit', guiding participants through a thoughtful examination of their cherished objects in relation to disaster scenarios. Participants were encouraged to recreate these objects using clay, contemplating their temporal and emotional resilience to disasters. This redesign leveraged the concept of material engagement theory, suggesting that hands-on interaction with materials can enhance cognitive and emotional engagement with the learning content (Malafouris, 2013).
- 3. Setting the Stage for Disaster Awareness:** Varied interpretations of the term 'disaster' among participants pointed out the need for a clearer conceptual framework. The booklet was then accordingly revised to include targeted questions that elicited participants' definitions and perceptions of disasters. Inspired by research on the human influence on natural phenomena and disaster creation, a flow diagram was introduced to visually delineate the relationship between human actions and disaster outcomes, employing visual learning theories to facilitate understanding and reflection (Ainsworth, 2006; Cañas, n.d.; Cook, 2006). The diagram also aimed to initiate reflection on the fact that our actions at the present time can lead to

or increase disaster risk, setting the tone for the following activities in the booklet.

The insights leading to this set of revisions were informed by the two participants who took part in this phase of the study and by examining how they interacted and engaged with Probe V.2. Consequently, these revisions marked the creation of the next version, Probe V.3.

4.4. KIT 3.0: NAVIGATING TOWARDS THE FINAL CONFIGURATION

Further down the design process, Probe V.3 built upon the revisions on the previous probe version, was prototyped and tested with another set of two participants from the target age group. The results indicated that many of the redesigns and revisions effectively strengthened the connection to DRR concepts and enhanced overall participant engagement aligning well with the research aims and objectives. However, after observing how participants interacted with Probe V.3, it became evident that the memory probe activity continued to be a challenge. One participant did not engage with this activity, leaving blank booklet pages. This disengagement aligns with findings in participatory design, which suggest that tasks that fail to resonate with participants often result in disengagement (Spinuzzi, 2005). Informal follow-up conversations with the participants revealed that the memory probe, in its current form, did not provide meaningful value for this study. After further brainstorming and discussions with PhD peers and academic experts, the decision was made to completely rethink the activity and potentially replace it with one that would better align with the study's objectives and improve participant engagement.

Moving on to the design of Probe V.4, the decision to discard the memory probe activity was not taken lightly. After thoroughly evaluating a range of alternative activities within the realm of design probes, a decision was made to replace it completely with another activity, building on prior explorations. This was not a complete overhaul but rather an informed iteration based on prior explorations. In the early stages of the design process, in the design of Probe V.1, I experimented

with a board game, which, upon revisiting, showed potential for adaptation to the current research context and probe version. The redesigned board game incorporated narrative elements centred around the character 'Kit', enhancing engagement and relevance for the participants.

The revamped board game is structured into multiple stages to guide participant interaction. Initially, participants are introduced to the activity and assemble the game pieces, which include a board mapping out the four key spaces: school, outdoors, home, and a custom space where participants can decide and choose what setting that space represents. Participants then model these spaces with clay, adding a tactile, hands-on, and creative element to the experience. Previous research supports the integration of tactile activities by showing that hands-on engagement and physical experiences can enhance cognitive processing and retention (Kontra et al., 2015). This setup fosters engagement and tailors the activity to individual experiences, making it particularly relatable for participants from varied backgrounds and perspectives. Following the creative assembly, the game introduces a 'dice of disaster' scenario where participants navigate through potential disasters in each defined space. This interactive approach is designed to elicit responses on disaster preparedness and decision-making in crisis situations, enhancing the depth of data collected regarding participants' readiness and situational awareness (Chee, 2015; Dignan, 2011). Figure 14 presents the prototypes of this activity's components, Figure 15 illustrates the process of creating and developing these components, and Figure 16 displays the booklet pages that guide participants through constructing the pieces and exploring the spaces.

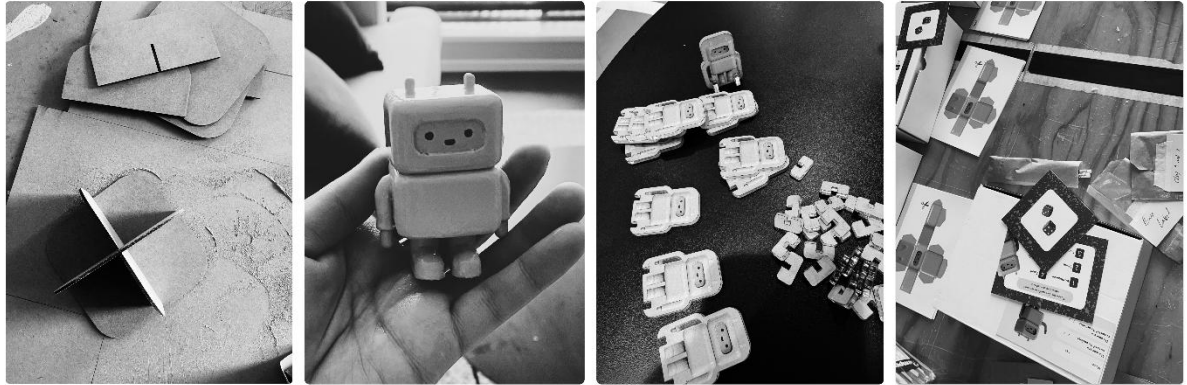


Figure 14. Prototypes of the game board activity components



Figure 15. The making of the board game activity components

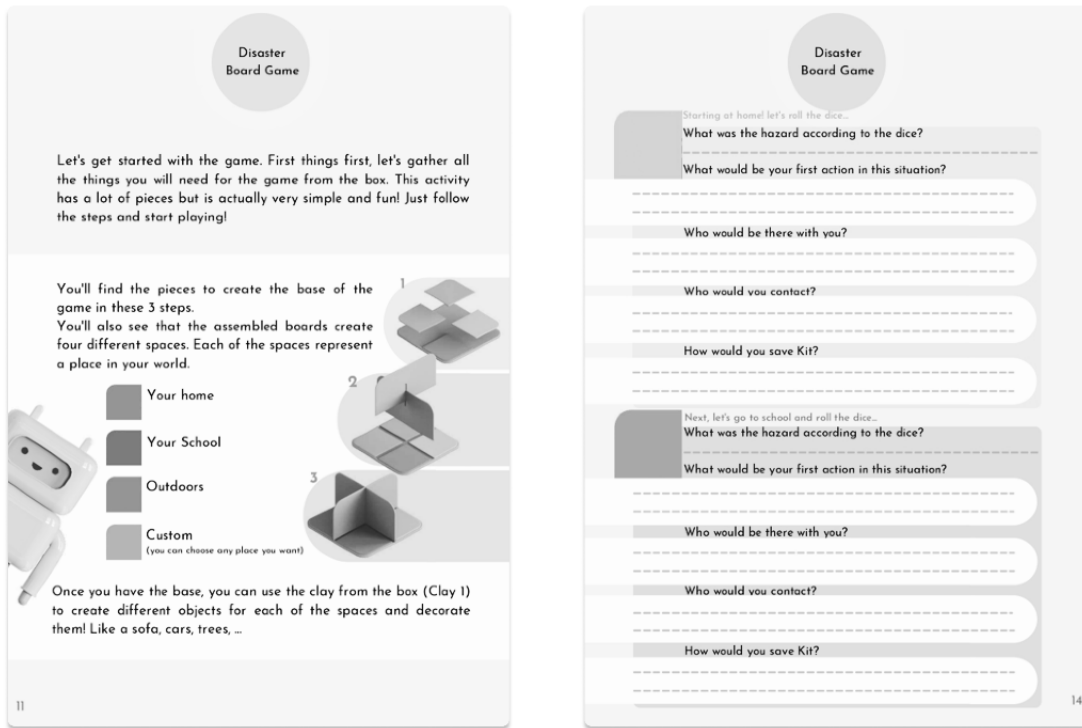


Figure 16. Booklet Pages of probe V.3 on the board game activity

Parallel to the board game, I developed a 'future thinking' activity centred around a time capsule, guided by the character Kit. This activity aims to encourage participants to project their thoughts into the future, contemplating their personal and communal resilience against disasters while working in three stages: exploring the present, reflecting on tools and resources available, and finally, imagining future scenarios critical to fostering reflection about disaster risk and the consequences/sustainability of our actions. In the first stage, participants reflect on their current situation and environment, observing and documenting their present preparedness and available tools. In the second stage, participants critically assess these tools and resources, reflecting on how they could be better prepared for natural hazards and disasters. In the third stage, participants project into the future, imagining potential disaster scenarios and their responses. This three-stage process aligns with research on future-oriented thinking and scenario

planning, where participants evaluate the present before reflecting on possible future outcomes (Iversen, 2015; Ramirez & Wilkinson, 2016).

This activity's imaginative, future-thinking component also draws on design fiction methodologies, which encourage participants to envision plausible futures based on their current realities. Design fiction often involves drawing conclusions from current conditions to explore how present actions and resources may shape future scenarios, thus promoting critical thinking and problem-solving (Bleecker, 2022a; Ventä-Olkkonen et al., 2021). By guiding participants through this process, the time capsule activity fosters deeper reflection on disaster preparedness, resilience, and personal agency in disaster risk reduction. The design fiction framework is particularly useful in DRR contexts as it allows participants to critically explore both desirable and undesirable future scenarios, promoting proactive disaster planning. Design fiction's speculative approach helps participants move beyond the constraints of their present environment, imagining new possibilities while remaining grounded in reality (Lindley & Coulton, 2016; Raby & Dunne, 2013). This process encourages participants to engage with disaster preparedness creatively and reflectively, considering how their actions today could influence future disaster outcomes. As a result, this design fiction and future thinking-inspired activity was designed to capture the following steps, as shown in Figure 17: Exploring the present, reflecting on tools and resources, and finally, imagining and exploring future disaster risk scenarios.

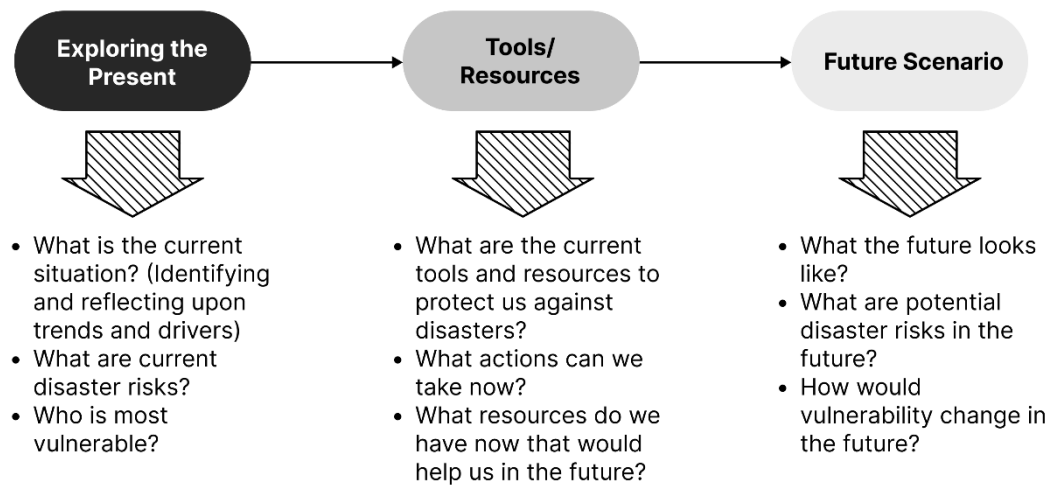


Figure 17. Exploring current status, tools/resources and future scenarios

The inclusion of these two activities, the board game and the time capsule activity, aimed to replace the previously ineffective memory probe activity with mechanisms that contribute to gaining insights and data that would be better aligned with the research aims and objectives through engaging participants in meaningful and reflective discussions about disaster preparedness and risk reduction.

Another key realisation during this stage of the design process, before finalising and prototyping Probe V.4, was the absence of a clear approach to capture participants' overall feedback on their experience, engagement, and, most importantly, the impact of the probes on their understanding of disasters, disaster risks, and disaster preparedness, one of the main objectives of the study. The assessment of the impact of these redesigned activities required a more thorough exploration and a stronger methodological approach. Simply studying the participants' answers in the booklet did not provide sufficient depth into how effectively the probe kit influenced their understanding and awareness. To address this gap, and after considering various options, such as adding a questionnaire to the end of the probe booklet or implementing focus groups after participants' interactions with the probes, a pre- and post-interview strategy was chosen and

implemented due to the approach's logistic flexibility and relativity to the context of the study. This approach, informed by previous research (Campbell et al., 1963; Stratton, 2019), allows for a comparative analysis of participants' knowledge and attitudes before and after interacting with the probe kit. These interviews not only facilitate the collection of in-depth qualitative data but also create a relaxed and communicative environment that enhances participant engagement and insightfulness.

This design, Probe V.4, was also prototyped and tested with two additional participants, alongside the pre- and post-interviews. This combination proved effective in addressing issues identified in earlier versions of the probes. The pre- and post-interviews were particularly valuable in assessing how well the study had done in achieving its research objectives and in gauging the overall impact of the probes on participants' understanding and engagement with DRR.

4.5 KIT: READY FOR ACTION

Finally, the research design and the arrangement of activities within the probe kit, coupled with the pre/post-test interviews, appeared effective in addressing the research aims and objectives. With Probe V.4 proving to be more effective and aligned with these objectives, it was time to test the prototype with a larger group of participants. This led to the development of Probe V.5, which essentially retained the core elements of Probe V.4, but included final updates to ensure an improved user experience. These updates focused on enhancing the aesthetics, ensuring that the probe kit was both functionally effective and visually engaging.

Key revisions to Probe V.5 included adjustments to the look and feel of the activities, improving the overall visual appeal, and refining the templates, pages, and examples provided by Kit, as research shows that aesthetics can play a critical role in participant engagement, particularly in learning environments and settings (Norman, 2007; Norman Donald, 2013). The design was informed by user experience (UX) principles, where usability and accessibility were prioritised to

enhance participant interaction. UX design emphasises the importance of clear information architecture, visual hierarchy, and colour contrast to ensure ease of use and cognitive engagement (Garrett, 2022; Nielsen, 1994).

Moreover, special attention was given to ensuring that colours provided enough contrast for ease of reading, the information architecture was clear, and instructions were easy to follow. Adequate contrast and clarity in design elements are essential to avoid cognitive overload and enhance learning (Sweller et al., 2011). Additionally, sufficient space was allocated for participants to respond to questions, complete drawings, and engage with the activities without feeling constrained. These final revisions balanced both academic content and user-centred design principles, ensuring that educational impact and participant engagement were maximised. User-centred design methodologies stress the importance of making tools adaptable to user needs, ensuring ease of interaction and promoting sustained engagement. Probe V.5 was then tested with 20 participants to further assess its effectiveness. The increase in participant numbers aligns with best practices in research design for scaling prototypes, where larger sample sizes help validate the effectiveness of the designed tools and ensure reliability in findings (Creswell & Creswell, 2022). The feedback from this larger group provided valuable insights into both the content and design elements of the probe.

Table 2 shows how Kit evolved throughout the study, outlining the frameworks, development process, rationale, and outcomes for each activity, along with the changes made across different versions. This table highlights the thought process behind each iteration, what worked, what didn't, and how adjustments were made to better engage children in DRR. One of the biggest shifts was the introduction of Kit as a guiding character, which came after early feedback showed that children were more engaged when activities had a clear narrative. Each refinement brought the probes closer to being more effective, interactive, and relevant to the study's goals.

Table 3 provides a snapshot of how different probe versions performed, summarising the key activities, number of participants, and overall effectiveness in meeting the study's objectives. It helps illustrate the gradual improvements made to the probes, moving from exploratory early versions to more structured and engaging activities that resonated better with participants. The table also captures how each iteration contributed to a deeper understanding of DRR concepts, showing that refining the design over time led to an overall more meaningful engagement.

Following the tables, Figures 18, 19, and 20 present the final design of the probe kit, including all the components. These figures illustrate the probe version that evolved through iterative prototyping and testing, ultimately shaping the final structure, format, and arrangement of activities and materials.

Table 2. Evolution of Kit.

Activity Version	Probe Version	Activity Description	Activity Materials	Activity Rationale	Participation Format	Outcome	Framework and Model References
Photo Elicitation V.1	Probe V.0 (Initial Exploration)	Participants were asked to arrange images of different types of disasters in order of the impact they can have. This activity served as an icebreaker to engage them in thinking about disasters and their effects.	Image cards with illustrations of different kinds of disasters.	To engage participants in thinking about disasters and their impacts, initiate discussion and reflection. The visual nature of the activity aimed to stimulate interest and make abstract concepts more tangible.	Group Setting	Needed further revision: Provided initial engagement but lacked depth in exploring participants' views on DRR.	(Epstein et al., 2006; Harper, 2002)
W-Questions Prompting V.1	Probe V.0 (Initial Exploration)	Participants were encouraged to come up with 'W' questions (Who, What, When, Where, Why, How) within the realm of DRR to ask one another in small groups and then answer them. This activity aimed to gain insights into their existing knowledge and experiences with disasters and to initiate conversations and peer learning.	Question prompt cards, pens, paper for note-taking.	To stimulate critical thinking and peer-to-peer learning by encouraging participants to formulate and discuss questions about DRR. This activity aimed to uncover participants' prior knowledge and misconceptions, facilitating a collaborative learning environment.	Group Setting	Needed further revision: Fostered conversation but required more structure to elicit deeper insights.	(O'neill & Nicholson-Cole, 2009; Saxton et al., 2018)
Board Game V.1 (Character 'X')	Probe V.1	Introduction of a narrative-driven character called 'X' with a board game that invites participants to help the character learn about disaster preparedness and resilience through exploring different imaginary disaster scenarios. Accompanied by questions and prompts	3D-printed character, clay models, laser-cut game pieces	To enhance participant engagement through narrative and gamification of disaster preparedness concepts. The character 'X' was designed to foster empathy and motivation to assist in learning about DRR.	Group Setting	Needed further revision: Did not fully achieve a deep engagement in participants with DRR concepts.	(Chee, 2015; Dignan, 2011; A. V. Gampell et al., 2017)

		to engage participants in deeper reflection and problem-solving.					
Board Game V.2 (Character 'Kit')	Probe V.4, and V.5	A narrative-driven board game with 'Kit,' where participants help Kit navigate disaster scenarios in four key spaces: home, school, outdoors, and a customisable space. Participants model these spaces using clay and then engage in disaster preparedness decision-making through a 'dice of disaster' scenario.	Dice, Dice Guide, clay models, laser-cut game pieces	To foster deeper engagement with DRR concepts by encouraging participants to reflect on disaster preparedness in familiar spaces, using hands-on, creative elements to enhance learning and engagement.	Individual	Successful: Enhanced participant engagement and relevance of DRR concepts. Helped participants understand disaster preparedness in everyday contexts.	
Ice breaker flow diagram activity V.1	Probe V.3, V.4, and V.5	Inclusion of targeted questions to elicit participants' definitions and perceptions of disasters, with a flow diagram to visually explain the relationship between human actions and disaster outcomes. This activity set the stage for subsequent activities by clarifying key concepts.	Flow diagram templates, pencils, and Kit's guide booklet.	To address varied interpretations of 'disaster' by providing a clear conceptual framework. Visual aids facilitated understanding of the human impact on disasters, encouraging reflection on personal and communal responsibilities in DRR.	Individual	Successful: Effectively clarified key concepts and prepared participants for later activities.	(Cañas, n.d.; Cook, 2006)
Diary V.1	Probe V.2	Inspired by more traditional probe studies, this diary exercise aimed to gain insights into participants' daily lives by prompting participants to document a typical day in their lives, the places they visit, the people they interact with, and their emotions.	Printed diary templates, pens, and mapping tools (stickers, markers).	To serve as an icebreaker and gateway to the next activities in the booklet and to gain insights into participants' awareness of disaster risks, family dynamics, and potential resilience strategies.	Individual	Needed further revision: Lacked direct connection to DRR themes. Did not contribute to achieving the study goals.	(Azmi & Abdul Razak, 2015b; Graham et al., 2007b)

Diary V.2	Probe V.3, V.4, V.5	Enhanced diary activity with emoji stickers for emotional annotation and guided examples from 'Kit' to connect daily activities with DRR themes. Participants documented their routines while reflecting on potential disaster risks in their environment.	Printed diary templates, emoji stickers, pens, Kit's guide booklet.	To directly link the diary activity with DRR themes by encouraging participants to observe and reflect on their surroundings for potential risks. This link, missing in the previous version of the activity, was made possible by the use of emojis with enhanced expressiveness while guided examples aided in critical observation and reflection.	Individual	Successful: Improved engagement and a much stronger connection to DRR, by encouraging participants to develop an eye for identifying disaster risks.
Detective Role Playing Game V.1	Probe V.2	Role-playing game where participants identify disaster risks and promote family discussions on disaster preparedness. Participants took on the role of 'detectives' to spot potential hazards and discuss preparedness measures.	Detective role cards, family discussion prompts, risk identification sheet (within booklet pages).	To foster active engagement with disaster risk identification and family discussions on disaster preparedness. Encouraging participants to take an active role enhances motivation and ownership of learning about DRR.	Individual and Family/House hold	Needed further revision: Participants found instructions ambiguous, causing confusion. (Bernhaupt et al., 2007b; Russ et al., 1999; Tellols et al., 2016b)
Detective Role Playing Game V.2	Probe V.3, V.4, V.5	Revised role-playing game with clearer instructions and narratives from 'Kit'. Enhanced guidance helped participants better understand the tasks, improving engagement in disaster risk identification and preparedness.	Revised role cards, clearer instructions, Kit's guide booklet.	To improve understanding and engagement by providing clearer instructions and context. Enhancing the narrative and guidance aimed to reduce confusion and increase the effectiveness of the activity in conveying deeper understanding and reflection on DRR themes.	Individual and Family/House hold	Successful: Improved clarity led to better participant engagement.
Memory Probe Activity V.1	Probe V.2	Memory probe activity exploring cherished objects in disaster contexts. Participants reflected on their important personal items and considered their	Printed memory probe sheets (within booklet pages), pencils, clay.	To delve into participants' perceptions and emotional connections to disasters through their cherished objects, aiming to uncover nuanced perspectives on disaster awareness and preparedness.	Individual	Needed further revision: Participants struggled to understand the activity's purpose and overall flow. (Petrelli et al., 2009; Tsai & Hoven, 2018b)

		significance in disaster scenarios.				
Memory Probe Activity V.2	Probe V.3	Restructured memory probe activity with clearer introductory questions and narratives from 'Kit'. Participants recreated cherished objects using clay, contemplating their significance and reflecting on their resilience in imaginary disaster scenarios.	Printed memory probe sheets (within booklet pages), pencils, clay.	To prompt thoughtful reflection on the emotional and temporal significance of personal objects in the context of disasters. Hands-on interaction with materials was intended to enhance cognitive and emotional engagement with DRR concepts.	Individual	Needed further revision: Despite changes, still did not meet research objectives; eventually replaced completely with another activity.
Time Capsule V.1	Probe V.4	Introduction of a 'future thinking' time capsule activity guided by 'Kit'. Participants projected their thoughts into the future regarding personal and communal resilience against disasters. They contemplated future scenarios and their role in disaster preparedness.	Time capsule templates, Kit's guide booklet, pencils.	To encourage imaginative and critical engagement with possible futures, enhancing understanding and preparation for potential crises. Leveraging design fiction facilitated creative outputs and emotional expressions related to DRR from participants' perspectives.	Individual	Needed further revision: Initial version required adjustments for clarity and engagement. (Iversen, 2015; Peek, 2008a; Ventä-Olkkonen et al., 2021)
Time Capsule V.2	Probe V.5		Updated time capsule templates and refined Kit's guide booklet.	To enhance the activity's effectiveness by incorporating feedback, ensuring it aligns with the research objectives and effectively engages participants in future thinking about DRR.	Individual	Successful: Participants engaged deeply, providing valuable insights.

Table 3. Probe versions and their activities.

Probe Version	Activities Included	Number of Participants	Effectiveness in Achieving Research Objectives
Probe V.0	Photo Elicitation V.1, W-Questions Prompting V.1	2	Partially effective: Activities sparked initial engagement but lacked depth in connecting participants' views to DRR concepts, requiring further revision to strengthen relevance and connection to the study's objectives.
Probe V.1	Board Game V.1 (Character 'X')	2	Partially effective: Engaged participants through narrative elements but did not fully foster deeper understanding of DRR concepts. Feedback indicated that both activities needed more refinement to link participants' actions and reflections to disaster preparedness.
Probe V.2	Diary V.1 (Emoji Stickers), Detective Role-Playing Game V.1, Memory Probe Activity V.1	2	Moderately effective: The redesigned diary activity improved emotional engagement, but the memory probe and role-playing game lacked clarity, making it difficult for participants to connect the tasks to DRR themes. Further revisions were needed to improve activity alignment with research goals.
Probe V.3	Diary V.2 (Refined), Detective Role-Playing Game V.2 (Clearer Instructions), Memory Probe Activity V.2 (Restructured)	2	Moderately effective: Improved clarity and structure of activities enhanced engagement, but the memory probe still did not resonate with participants, leading to disengagement. As a result, it was decided to replace the memory probe in future iterations.
Probe V.4	Board Game V.2 (Character 'Kit'), Time Capsule V.1, Ice Breaker Flow Diagram Activity V.1	2	Highly effective: The redesigned board game and time capsule activities successfully engaged participants, fostering a deeper understanding of DRR concepts. The flow diagram helped clarify key disaster-related terms, contributing to better alignment with the research objectives.
Probe V.5	Board Game V.2 (Character 'Kit'), Time Capsule V.2, Ice Breaker Flow Diagram Activity V.2 (Refined)	20	Very effective: Achieved a high level of participant engagement and effectively met the research objectives. The updates to UX, aesthetics, and instructional clarity contributed to a meaningful participant experience and improved understanding of DRR concepts.

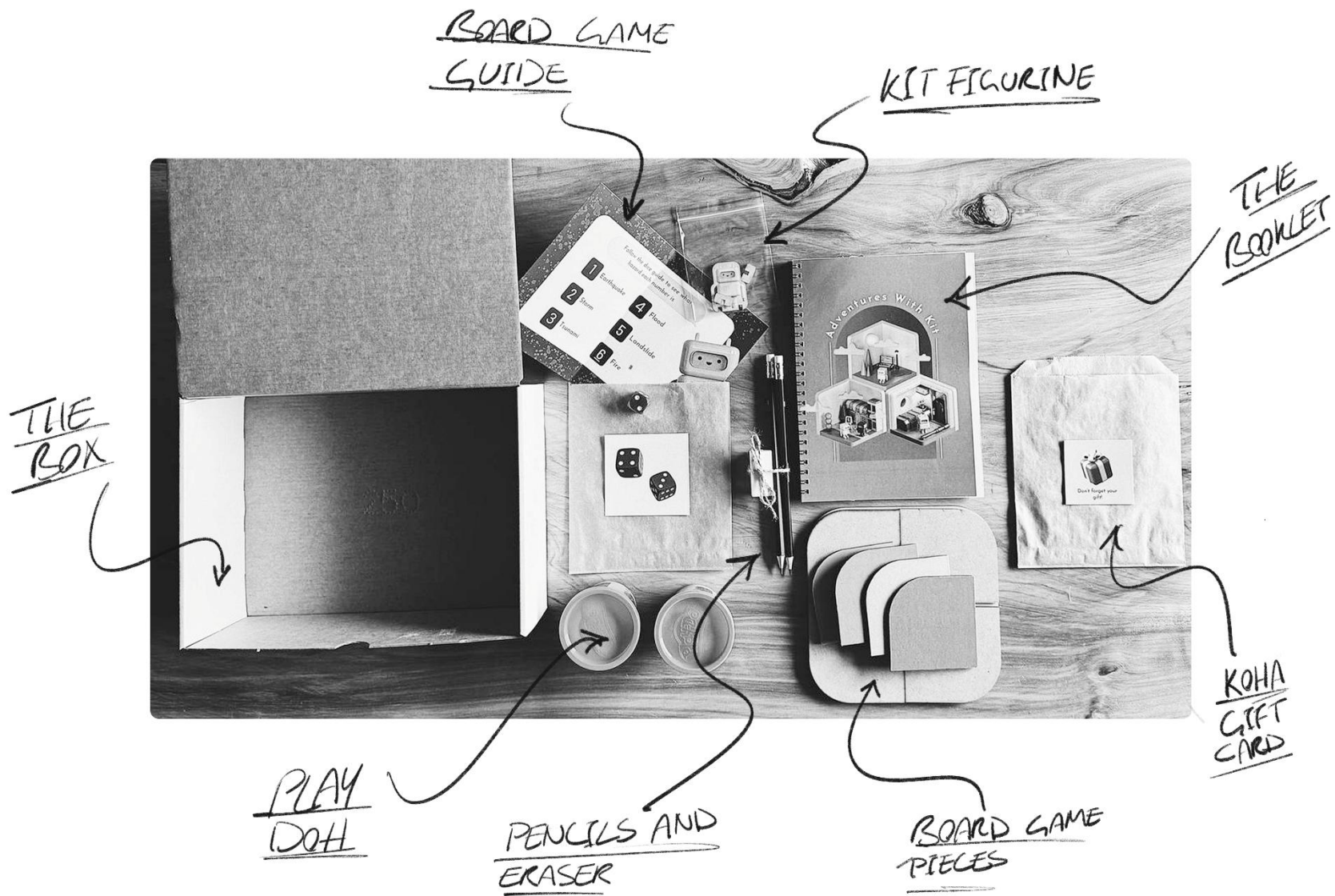


Figure 18. The final version of the probe kit and all its components

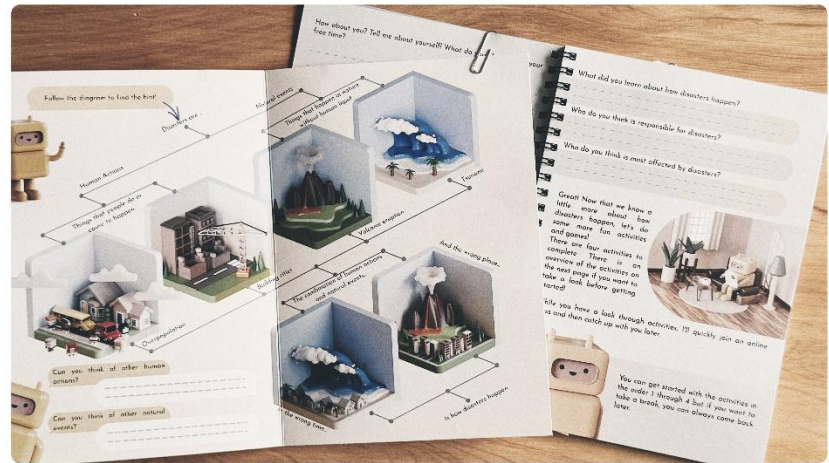


Figure 19. Examples of booklet pages along with components such as stickers and attached inserts.



Figure 20. Components of the disaster board game that participants put together and engage with during the activity.

4.6 CHAPTER SUMMARY

Chapter 4 details the iterative design process of the "Kit" probes created to engage children in DRR. It opens by outlining the initial design challenge, noting that many existing DRR resources offer limited creativity, interactivity, and opportunities for self-expression, which restricts children's ability to meaningfully connect with preparedness and resilience-building concepts. In response, the chapter explains how a sequence of prototyping rounds, informed by research insights, participant feedback, and design methodologies, shaped the development of probes intended to strengthen children's sense of agency in DRR. This process involved examining a range of design approaches before selecting design probes for their immersive, customisable, and participatory qualities.

Early prototypes were trialled with very small groups of participants (typically 2–3 at a time), enabling close observation of how children interacted with the activities and themes. Each iteration introduced refinements that drew on these observations, gradually enhancing the clarity, playfulness, and relevance of the materials. Features such as narrative characters, gamified elements, and diverse interactive activities were incorporated to align the probes with the study's aims and to encourage creative engagement with DRR concepts. Feedback gathered through pre- and post-test interviews informed the evolution from Probe V.1 to Probe V.5, ensuring each version more effectively supported learning and expression.

The final iteration, Probe V.5, was tested with a larger group of 20 participants, achieving both aesthetic and functional refinements, and ultimately demonstrating effectiveness in engaging participants and meeting the study's research goals. Collectively, these iterative developments point toward a future direction in DRR education that emphasises playful, child-driven engagement supported by thoughtfully designed tools.

*"Every great design begins with an
even better story..."*
– **Lorinda Mamo**



CHAPTER 5 – FINDING AND RESULTS

5.1. CHAPTER INTRODUCTION

This chapter presents a detailed analysis of the findings drawn from pre- and post-test interviews, as well as participants' interactions with the probe activities, focusing on the evolution of their understanding of DRR. The study was designed around key themes identified from the initial stages, including Disaster Awareness and Risk Assessment, Community and Household Level Involvement and Relationships, Knowledge and Resilience, Future Scenarios and Solutions, and Vulnerability-Focused Disaster Response and Support. These themes provided a starting point for exploring children's perspectives on DRR. However, as participants engaged with the probe activities and shared their insights and reflections, the themes evolved to reveal deeper, more nuanced understandings of disaster risks and preparedness. As the research progressed, it became clear that participants' interactions with the probe kit played a critical role in shaping these themes in richer, more detailed ways, reflecting their lived experiences, personal insights, and creative thinking.

The themes identified serve as both the structural and analytical lens for the study, each theme capturing critical aspects of DRR, from individual knowledge of disaster risks to community-level resilience and vulnerability considerations. These themes were also adapted based on how participants navigated the probe kit and shared their thoughts during interviews. For instance, while *disaster awareness and risk assessment* emerged as a central focus from the beginning, participants' deeper engagement with risk perception, exploration curiosity, and resource evaluation added more nuance to the understanding of how children view and interpret disaster-related scenarios in their everyday lives. Similarly, themes such as *community and household involvement* grew in importance as participants reflected on their roles within their families and communities, highlighting a shift from individual preparedness to a broader collective responsibility.

The guiding frameworks that helped shape this study, including the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015) and Bronfenbrenner's ecological systems theory (Bronfenbrenner & Morris, 2007), provided the conceptual basis for this exploration. The Sendai Framework provided a basis for exploring DRR-related concepts, while Bronfenbrenner's Ecological Systems Theory provided a basis for approaching the design for learning within the study, focusing on children and how they interact with, explore, and discover their environments. By grounding the analysis in these frameworks, the study aligns with globally recognised strategies for disaster risk reduction while also contributing new insights into how children perceive and engage with these issues. The participants' evolving understanding, as revealed through the probe activities and interviews, reflects the complex interplay between personal knowledge, family dynamics, and broader social structures, reinforcing the relevance of these frameworks in shaping disaster education.

As the chapter unfolds, the analysis examines how each theme was reflected in participants' experiences and how their understanding of disaster preparedness, vulnerability, and resilience shifted from the pre- to post-test interviews. This analysis draws upon data from pre-test and post-test interviews, as well as participants' interactions with the probe activities. These findings emphasise the critical role that thoughtfully designed disaster education can play in enhancing children's understanding, sense of agency and ability to contribute to disaster preparedness at both personal and community levels.

5.2. THEMES AND CODES DEFINITIONS

The first theme, disaster awareness and risk assessment examines how participants can be inspired to explore their surroundings, recognise potential risks, and assess these dangers. It connects with Bronfenbrenner's Ecological Theory, which emphasises how environments influence perceptions and actions (Bronfenbrenner & Morris, 2007). This theme also aligns with the Sendai

Framework's emphasis on understanding disaster risks as the foundation for resilience (UNISDR, 2015). The focus here is on cultivating curiosity and hands-on engagement with risk awareness, helping participants actively contribute to their own safety and that of their communities (Pascua, 2019).

Community and household-level involvement and relationships highlight the significance of family and community networks in disaster preparedness. Strengthening communication at both the household and community levels is essential for building resilience, as highlighted by both the Sendai Framework and Bronfenbrenner's theory (UNISDR, 2015; Bronfenbrenner & Morris, 2006). This theme encourages participants to view disaster preparedness as a shared responsibility within families and communities rather than an individual effort (Paton, 2019).

The theme of Knowledge and Resilience focuses on linking knowledge acquisition with the capacity to withstand future disasters. It emphasises the importance of equipping individuals, particularly children, with the understanding required to navigate and respond effectively to disasters. This theme seeks to enhance confidence and build resilience through a deeper understanding of disaster scenarios (Johnson & Ronan, 2014). Future Scenarios and Solutions encourages participants to think critically about potential future disasters and consider proactive strategies for addressing them. This forward-thinking approach is vital for effective disaster planning, as outlined in the Sendai Framework (UNISDR, 2015). Envisioning future challenges helps foster long-term resilience and encourages innovative solutions, aligning with research that underscores the importance of preparedness for future risks (Gaillard & Mercer, 2013).

Finally, Vulnerability-Focused Disaster Response and Support addresses the need to recognise and prioritise the support of vulnerable populations during disasters. This theme emphasises the role of empathy and inclusion in disaster

preparedness, resonating with the Sendai Framework's goal of reducing vulnerability (UNISDR, 2015). Participants are encouraged to think critically about how disasters affect different groups and what strategies can be implemented to support those most at risk (Peek et al., 2018). Table 4 provides a detailed overview of the themes, their underlying codes, and how they are connected to established theoretical frameworks and research in disaster risk reduction.

Table 4. Breakdown of the themes and codes

Overarching Theme	Code	Description	Theoretical Framework	References
Disaster Awareness and Risk Assessment	Exploration Curiosity	Inspires children to actively explore disaster-related scenarios and discover potential risks in both their immediate and broader environments. By fostering a sense of curiosity, participants are motivated to think critically about hazards and develop a proactive interest in risk awareness and management.	Sendai Framework Priority 1: Understanding disaster risk. Bronfenbrenner's Ecological Systems Theory: Emphasises the role of immediate and broader environments in children's learning and risk perception.	UNISDR (2015); Johnson & Ronan (2014); Shaw & Oikawa (2014); Bronfenbrenner (1979); Shiwaku et al. (2016)
	Risk Perception	Encourages participants to become more aware of potential risks in their environments, inspiring them to explore how they interpret disaster risks and hazards. This exploration allows participants to deepen their understanding of vulnerabilities and how they might mitigate these risks.	Sendai Framework Priority 1: Strengthening local disaster risk knowledge through exploration. Bronfenbrenner's Ecological Systems Theory: Children's immediate surroundings (microsystem) and societal systems (macrosystem) shape their risk detection.	UNISDR (2015); Johnson & Ronan (2014); Amri et al. (2017); Bronfenbrenner (1979); Paton & Johnston (2001)
	Resource Awareness and Evaluation	Inspires participants to explore available resources and discover how to evaluate their effectiveness in disaster situations. Participants are encouraged to consider how these resources might be used to strengthen preparedness at both personal and community levels.	Sendai Framework Priority 1: Emphasises knowledge of resources for risk reduction. Bronfenbrenner's Ecological Systems Theory: Focuses on children's access to resources within their family, school, and community environments (microsystem, mesosystem, exosystem).	UNISDR (2015); Shiwaku et al. (2016); Bronfenbrenner (1979); Amri et al. (2017); Gaillard & Mercer (2013)
Community and Household Level Involvement and Relationships	Household Communication	Encourages participants to engage in open dialogue with their families about disaster preparedness, fostering collaboration in creating emergency plans and sharing disaster-related insights. This exploration helps participants understand the value of communication for coordinated preparedness.	Sendai Framework Priority 2: Strengthening disaster risk governance through coordination. Bronfenbrenner's Ecological Systems Theory: Families (microsystem) and the broader community (mesosystem) play a key role in children's disaster preparedness.	UNISDR (2015); Amri et al. (2017); Bronfenbrenner (1979); Vázquez et al. (2024)
	Household and Community Experiences and Preparedness	Encourages participants to reflect on and explore the experiences of their families and communities regarding past disasters. By understanding these shared experiences, participants develop a collective approach to preparedness and resilience, seeing disaster planning as a community effort.	Sendai Framework Priority 3: Building resilience through shared community experiences. Bronfenbrenner's Ecological Systems Theory: Family and community experiences are key to shaping children's preparedness (microsystem, mesosystem).	UNISDR (2015); Pearce (2003); Prime et al. (2023); Bronfenbrenner (1979); Shiwaku et al. (2016)

Knowledge and Resilience	Personal Experiences with Disasters	Inspires participants to reflect on their personal or family experiences with disasters, encouraging them to explore how these experiences have shaped their understanding of preparedness and resilience. This reflection promotes a deeper engagement with disaster risk reduction strategies.	Sendai Framework Priority 3: Investing in knowledge and education for resilience. Bronfenbrenner's Ecological Systems Theory: Children's past experiences (microsystem) influence their ability to develop resilience.	UNISDR (2015); Becker et al. (2012); Bronfenbrenner (1979); Ronan et al. (2016)
	Knowledge of Disasters and Preparedness Measures	Encourages participants to explore their understanding of disaster risks and discover preparedness measures that can be applied at individual and household levels. Through inquiry and hands-on activities, participants deepen their knowledge and strengthen their preparedness strategies.	Sendai Framework Priority 3: Building resilience through knowledge. Bronfenbrenner's Ecological Systems Theory: Children's direct interactions with family, school, and community (microsystem and mesosystem) foster their understanding of preparedness.	UNISDR (2015); Campbell & Yates (2021); Bronfenbrenner (1979); Shiwaku et al. (2016)
Future Scenarios and Solutions	Future-Oriented Thinking	Inspires participants to engage in forward-thinking and imagine future disaster scenarios, encouraging them to explore how present-day actions can influence future risk mitigation. This future-focused approach fosters critical thinking and long-term disaster resilience.	Sendai Framework Priority 4: Enhancing disaster preparedness for future response. Bronfenbrenner's Ecological Systems Theory: Future scenarios are shaped by children's evolving understanding of their role in the world (macrosystem).	UNISDR (2015); Ralph et al. (2020); Bronfenbrenner (1979); Izumi et al. (2019)
	Future-Oriented Solutions	Encourages participants to imagine innovative solutions to potential disaster risks, inspiring them to think creatively and critically about how they can contribute to future disaster preparedness. This exploration fosters proactive problem-solving in disaster management.	Sendai Framework Priority 4: Strengthening disaster response strategies. Bronfenbrenner's Ecological Systems Theory: Children's creative thinking and problem-solving (macrosystem) foster proactive preparedness for future disaster risks.	UNISDR (2015); Gaillard & Mercer (2013); O'Brien & O'keefe (2013); Bronfenbrenner (1979)
Vulnerability-Focused Disaster Response and Support	Perception of Vulnerability	Inspires participants to explore the concept of vulnerability, encouraging them to reflect on who might be most at-risk during disasters and why. By engaging with this concept, participants gain a deeper understanding of the social factors that contribute to vulnerability.	Sendai Framework Priority 1: Addressing the needs of vulnerable groups in disaster scenarios. Bronfenbrenner's Ecological Systems Theory: Children's understanding of vulnerability shaped by their interactions with their community and society (mesosystem, macrosystem).	UNISDR (2015); Le Masson (2015); Bronfenbrenner (1979); Paton (2017)
	Vulnerability Reflections and Support	Encourages participants to explore and reflect on how they can support vulnerable groups during disasters. Participants are inspired to think about actionable strategies to address vulnerability and offer support, contributing to a more inclusive and effective disaster response.	Sendai Framework Priority 3: Strengthening support systems for vulnerable groups. Bronfenbrenner's Ecological Systems Theory: Children's understanding of societal responsibility for vulnerable populations shaped by broader societal values (macrosystem).	UNISDR (2015); Norris et al. (2008); Bronfenbrenner (1979); Tierney (2019)

5.3. INTERVIEW, PROBE INTERACTIONS, AND THEMATIC ANALYSIS RESULTS

On average, participant interviews lasted approximately 8:12 minutes, with pre-test interviews ranging from 5:34 to 14:24 minutes, and post-test interviews ranging from 6:10 to 11:13 minutes. Although the interviews provided valuable insights, they were not the primary focus or method of data collection in this study. Instead, they served as a supportive tool to help understand the impact of the probe kits on participants' learning and experiences. The interviews were intentionally kept short to maintain a lively and engaging atmosphere and to make sure that children remained focused and comfortable throughout the process. The interviews also played a critical role in motivating participant engagement by creating a friendly and open environment where participants felt comfortable sharing their thoughts and opinions freely. The main emphasis, however, was on the probe kits themselves, which were the central element for gathering data in this study. The interviews, on the other hand, had complementary purposes, allowing for the triangulation of information to gain a deeper understanding of participants' learning, experiences, and reflections. These kits were designed to be immersive and interactive, allowing participants to engage directly with the study's educational materials over the two-week period. For most participants, the test period lasted two weeks, but a few required up to three weeks due to illness, schoolwork, or family commitments. The probe kits were specifically crafted to elicit meaningful interactions, and the feedback collected was instrumental in assessing their effectiveness and adaptability. Participants were predominantly female (n=15, 75%) and came from diverse cultural, ethnic, and socio-economic backgrounds, which was essential for capturing a broad range of perspectives, especially given the diverse population in Auckland, New Zealand. This diversity helped to explore how different factors influenced participant engagement with the probe kits, ultimately shaping a more comprehensive understanding of their functionality across varied demographic groups.

5.3.1. THEME 1: DISASTER AWARENESS AND RISK ASSESSMENT

The theme of Disaster Awareness and Risk Assessment captures the critical role that knowledge, awareness, and the ability to assess risks play in DRR. The integration of disaster awareness and education with risk assessment forms a foundational element in shaping how individuals and communities understand, prepare for, and respond to disasters. The Sendai Framework for Disaster Risk Reduction (SFDRR) stresses the importance of public awareness, education, and accurate risk assessments in building resilience and reducing vulnerability to disasters (UNDRR, 2015). The combination of these factors fosters a proactive approach, enabling individuals and communities to be better equipped against disasters (Grover et al., 2022; Paton, 2017). Given the context and dimensions of this study, this theme is defined through the exploration of four underlying codes: Exploration Curiosity, Perception of Risks, Risk Detection, and Resource Awareness and Evaluation.

Exploration Curiosity reflects the natural curiosity children possess, which can be targeted to exploring disaster-related scenarios within their immediate environments (microsystem) and broader contexts (macrosystem). By fostering this curiosity, children can become more aware of potential disaster risks and develop a deeper interest in disaster preparedness. Research indicates that curiosity is a powerful motivator for learning, particularly in areas like disaster education (Johnson et al., 2014; Ronan & Johnston, 2005). Many of the probe activities were intentionally designed to bring out this curiosity. For example, the Detective Role-playing Game encouraged participants to explore their surroundings for clues about potential disaster risks.

Insights from the pre-test and post-test interviews, as well as participants' responses in the booklet, revealed an increase in Exploration Curiosity. During the detective game, one participant provided detailed drawings and notes identifying various hazards, ranging from small-scale risks like a fire in the house to more significant risks such as getting trapped indoors due to heavy snow or

encountering falling rocks while on holiday. These drawings and notes, illustrated in Figure 21, demonstrate the participant's thoughtful engagement and growing ability to identify potential disaster risks in their environment.

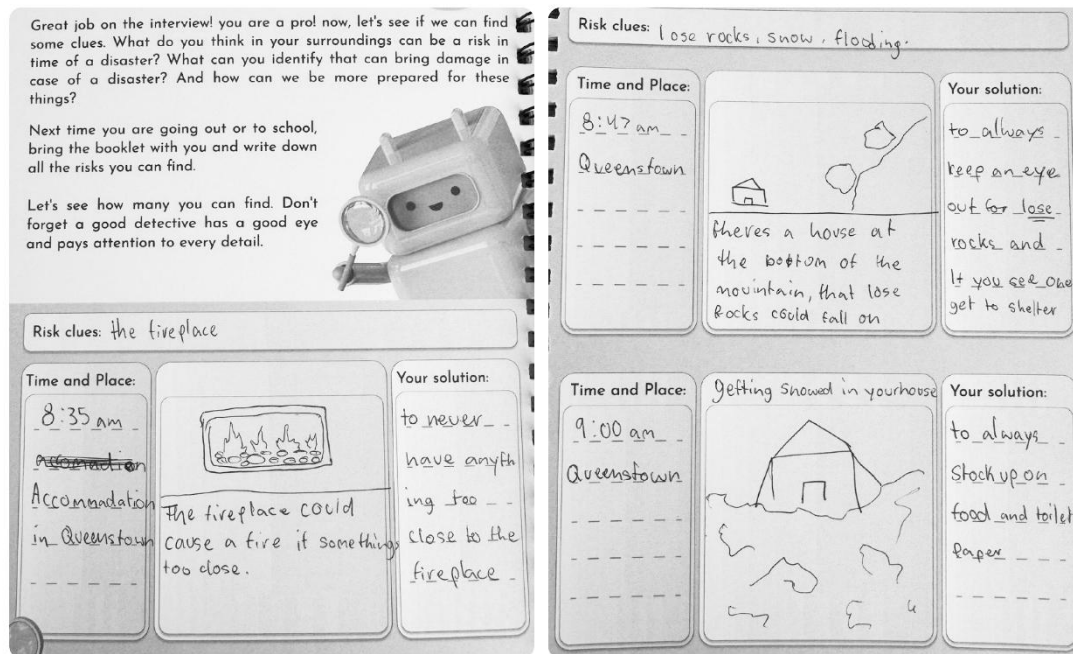


Figure 21. Pages from Detective Role-playing Game of the Kit booklet – Participant #7.

The comparison between participants' responses to the pre- and post-test interview questions reveals that the probe activities were effective in sparking curiosity and encouraging exploration within the context of disasters. Most participants demonstrated an increased awareness of disaster risks, particularly those relevant to their environment, with 16 out of 20 participants explicitly mentioning or reflecting on these risks during the study. When asked to define disasters, participants frequently mentioned events that were directly related to their own experiences, such as floods or storms, indicating that the activities prompted them to think critically about the risks present in their daily lives and environments. A more striking example of this shift in awareness comes from Participant #7, who, in the post-interview, remarked:

"I think disasters are created when you don't pay attention to your surroundings and when you forget. Because sometimes when you forget, like say you forget you're cooking something, then boom, FIRE! So, I'd say disasters are created when you forget, and you don't look at your surroundings." (Post-test Interview, Participant #7)

This response illustrates an enhanced understanding of disaster risks, particularly those that can arise from everyday actions such as cooking. The participant's reflection highlights the importance of paying attention to one's surroundings and being mindful of potential hazards, qualities that are key to disaster prevention. This increased awareness aligns with research emphasising the role of habit-building and mindfulness in DRR. Studies suggest that fostering a habit of risk detection and environmental awareness, especially from a young age, can significantly contribute to building more disaster-resilient communities in the future (Paton, 2019b; Ronan & Johnston, 2005).

Moreover, this growing curiosity and proactive exploration of risks demonstrated by the participants suggest that the probe activities successfully engaged them in thinking critically about their own environments. By encouraging participants to identify disaster risks in their daily lives, the activities helped to shift their perspective from viewing disasters as distant, abstract events to recognising them as real, immediate threats that require awareness and preparation. This shift is crucial for building long-term resilience, as it empowers individuals to take responsibility for identifying and mitigating risks in their surroundings.

Risk Perception aims to capture insights into how participants interpret disasters and perceive disaster risks. This understanding is crucial, as risk perception significantly influences individuals' disaster preparedness behaviours (Paton, 2017). Understanding children's perspectives on risk is especially essential for

designing disaster risk reduction (DRR) initiatives that effectively address the needs of this vulnerable population (Mitchell et al., 2008). Children often view risks through the lens of their direct experiences, which can provide valuable insights into how they perceive disaster threats in their environments (Dikmenli et al., 2018). To this end, many of the probe activities and interview questions were designed to explore and understand how participants perceive disasters and disaster risks, and how they interpret disasters in terms of their causes, consequences, personal experiences, and strategies to overcome them. The participants' responses provided insightful perspectives, ranging from reflections on family dynamics and personal experiences to imaginative scenarios involving potential disaster risks. These responses highlight the importance of considering children's imaginative viewpoints and how they perceive disaster risks in the context of DRR.

For instance, when prompted to document disaster risks, they identified in their surroundings; one participant responded, *"A risk at my house-there are some uncovered outlets, and that can be dangerous"* (Booklet Diary Activity, Participant#17), while in another case, a participant responded, *"Lower levels of buildings very susceptible to flooding."* (Booklet Diary Activity, Participant#19). These responses reflect the participants' ability to comprehend disasters across a wide range of scales, from minor personal events to large-scale tragedies. It also aligns with research indicating that people's perceptions of disaster risks influence how well-prepared they are for such events. Understanding these perceptions is crucial for developing DRR strategies that foster increased awareness and preparedness in vulnerable groups, especially children.

A comparison of the pre- and post-test interviews also reveals a significant increase in participants' understanding of disasters, how they are created, and their ability to recognise and perceive potential disaster risks in their surroundings and everyday environments. Initially, many participants viewed disasters as abstract, uncontrollable events. However, after engaging with the

probe activities, their understanding deepened, particularly around the role humans play in both causing and mitigating disasters. For instance, when participants were asked how disasters are created, many post-test responses reflected a new awareness of human influence on disaster risks. One participant, during an ice-breaker activity in the booklet, stated: *"Disasters can happen at any time, anywhere, and there's nothing we can do about it"* (Booklet, Ice-breaker question, Participant #8). However, by the post-test interview, the same participant had developed a more complex understanding of disasters, stating: *"Disasters are scary, disasters can be natural, or like, it's something that we've done."* This shift in perspective illustrates the participant's newfound recognition that human actions can contribute to the occurrence of disasters. The probe activities, which encouraged reflection on human behaviour and its consequences, helped foster this awareness. The same participant, when asked later about disaster preparedness, responded: *"Having like a family plan or something like that, helping people get safely out of the house."*

This response highlights the participant's growing understanding that people can take concrete actions to prepare for and mitigate the effects of disasters, an important evolution from their earlier belief that disasters were beyond human control. This shift in thinking, where participants moved from viewing disasters as purely natural phenomena to recognising the role of human agency, aligns with research emphasising the importance of fostering awareness and responsibility in DRR (Johnson et al., 2014). As research shows, developing a sense of personal responsibility and understanding of disaster risks is crucial for building disaster-resilient communities (Paton, 2019). Other participants showed similar shifts in their understanding of disasters. Many began to perceive disasters not as distant, uncontrollable events but as risks that can be managed with proper preparation. This increased awareness was particularly evident in how participants began to identify disaster risks in their surroundings and document what they perceived as potential disaster risks, an essential skill in DRR. Engaging in role-playing activities and exploring real-world scenarios

helped participants develop a critical awareness of potential hazards in their environment, encouraging them to think about proactive measures to reduce risks (Mitchell et al., 2008; Peek et al., 2018).

Resource Awareness and Evaluation focuses on alerting children about the resources available to them during a disaster and how to assess their effectiveness. This includes not only physical resources like emergency kits but also the social and institutional support systems children can rely on, such as family, school, and community networks. Studies suggest that increasing children's awareness of these resources significantly enhances their ability to respond to and recover from disasters (Johnson et al., 2014). By understanding how societal systems influence disaster preparedness and response, children can evaluate the utility of these resources in various disaster scenarios (Dikmenli et al., 2018).

Upon the exploration and analysis of this code, several key insights emerged from participants' interviews and interactions with the probe activities, particularly concerning their perspectives on resources available to them during disaster situations. Many of the interview questions and probe activities were designed with the aim of encouraging participants to reflect on these resources, sparking personal exploration and even conversations within families. This process led to discussions about creating family emergency plans between participants and their family members according to participants' answers and documentation, which also highlighted the importance of household and community relationships in disaster preparedness.

Participants shared a range of thoughtful responses, showcasing their understanding of both immediate and broader resource management in disaster scenarios. Many participants demonstrated a strong awareness of essential first steps, such as contacting family members or emergency services. Others emphasised the significance of government-issued alerts and notifications,

recognising these as critical tools in disaster response, which is indicative of their past experiences with disasters such as the floods that happened in Auckland in 2023. These findings are consistent with research on disaster preparedness, which brings focus to the value of public messaging and family-based planning as resources to enhance community resilience (Aldrich, 2012; Peek, 2008a). One particularly insightful response came when a participant reflected on how they would assist others during a disaster:

"I think by donating resources like help or objects to those people, can really help them. Or kind of try to take some of the burden of the disaster from them. So, it can vary in a lot of things, not all disasters are the same so it will be different from disaster to disaster, but I feel in general you can kind of offer your time, you can offer support like financial, or social, or mental and offer it to them." (Post-test interview, Participant #16).

This response highlights the participant's increased reflection and understanding of the diverse resources that can be offered in disaster situations. Notably, their emphasis on "offering time" demonstrates an awareness of the non-material forms of support that can make a significant difference during recovery. Research supports this, showing that psychosocial resources, such as emotional and mental support, play a vital role in helping communities recover from disasters (Norris et al., 2008; Tierney, 2019). Moreover, the participant's recognition that *"not all disasters are the same"* reflects an adaptive mindset, acknowledging that responses must vary depending on the specific type of disaster. This flexibility is critical for effective disaster management, as it allows individuals to adjust their actions according to the specific needs of the situation (Cutter et al., 2008; Paton, 2019). Their response also underscores the importance of viewing disasters through both a material and psychosocial lens, aligning with findings that successful disaster recovery often requires a

combination of physical resources and community support networks (Norris et al., 2008). Overall, comparisons on the participants responses to pre- and post-test interviews, revealed a deepened reflection and recognition of resources available to equip us against disasters and valuable insights bringing out the voices of participants on what are things they rely on and view as resources.

In one of the final activities in the booklet, a hypothetical future-thinking exercise called the Time Capsule Activity, participants were encouraged to propose resources to help people in the future mitigate disasters. By this stage in the booklet, participants had engaged in various activities that deepened their understanding and exploration of disasters and disaster risks. Their responses to this activity showcased thoughtful reflections and a deepened understanding of the types of resources they believed would be useful in the future. Participants offered a wide range of practical suggestions, such as *“stronger houses and bunkers, safety plans, and technology.”* These responses indicate an increased understanding of the importance of structural safety and strategic planning in disaster mitigation. Moreover, some participants demonstrated innovative and creative thinking, proposing ideas like *“Maybe lighting roads to knock electricity away, flood-activated boats in the corners of buildings”* (Booklet, Time Capsule Activity, Participant #12).

These imaginative solutions reflect participants' growing awareness of the potential for technology to play an important role in future resources against disasters. The idea of flood-activated boats, for instance, showcases how participants are thinking beyond traditional methods, envisioning creative technological advancements that could aid in disaster resilience. This aligns with research suggesting that fostering creativity in problem-solving helps individuals devise novel solutions to complex issues, especially in disaster contexts (Izumi et al., 2019b; O'Brien & O'keefe, 2013).

Furthermore, this activity highlights the participants' forward-thinking mindset, as they envision how future generations could benefit from innovations that blend technology and preparedness strategies. Their ability to think creatively about disaster management aligns with studies that emphasise the importance of involving children and young people in disaster risk reduction (DRR) to cultivate innovative approaches to resilience-building (Peek, 2008a; Peek et al., 2018). Overall, the responses in the Time Capsule Activity not only demonstrate the participants' increased understanding of effective disaster resources but also showcase their awareness of how advancing technology can support future disaster preparedness. Their creative thinking illustrates the potential of young minds to contribute to DRR efforts by offering unique, forward-thinking solutions. This underscores the value of integrating future-focused activities in disaster education to encourage imaginative and proactive approaches to risk management (Izadkhah & Hosseini, 2005; Izumi et al., 2019b).

5.3.2. THEME 2: COMMUNITY AND HOUSEHOLD LEVEL INVOLVEMENT AND RELATIONSHIPS

This theme of Community and Household Level Involvement and Relationships focuses on the significant role of family and community dynamics in promoting DRR and disaster preparedness at the household and community levels (Gumelar et al., 2020). These relationships are critical in building disaster-resilient communities and societies. The Sendai Framework for Disaster Risk Reduction emphasises the importance of enhancing disaster preparedness through community engagement and inclusive strategies that bring together all stakeholders, especially families and local communities, to strengthen collective resilience.

Previous research has shown that meaningful communication across households, extending into communities, has a deep effect on preparedness behaviours. Studies show that families who communicate effectively about potential risks and preparedness measures are more likely to adopt proactive

strategies that reduce disaster impacts (Gumelar et al., 2020; Vázquez et al., 2024). Additionally, such communication fosters the sharing of knowledge, experiences, and support systems, which are vital in managing post-disaster recovery and mitigating long-term effects. This integration of household communication into disaster preparedness strategies has been emphasised throughout this research, from the pre/post-test interviews to the interactive probe activities designed to foster discussion and reflection amongst participants and their household members. Two core codes emerged within this theme: household communication, household and community-level experiences and preparedness. These codes reflect the nuanced layers of interaction between family members and their communities, offering insights into how disaster risk awareness and preparedness efforts can be cultivated from within the household.

The concept of **Household Communication** refers to the interaction and exchange of ideas within families about disaster preparedness. This encompasses the interpersonal relationships among family members, which are essential for creating a shared understanding of disaster risks and response strategies. The Sendai Framework prioritises community-based disaster risk communication, recognising that strengthening household communication channels is a critical step toward reducing disaster vulnerability. Research in the field of DRR consistently highlights that families with strong internal communication networks are better positioned to mitigate disaster risks. Family discussions around disaster preparedness have been shown to increase both individual and collective awareness, leading to more informed and prepared households.

In this study, Bronfenbrenner's ecological systems theory, which emphasises the interactions between individuals and their immediate environments, was a central guiding framework. The theory's focus on the family as a primary context for children's learning and development aligns closely with this study's aim to

explore how children, through their interactions with family members, develop an understanding of disaster preparedness. This theory is particularly relevant to the theme of Community and Household Involvement and Relationships, as it highlights the importance of proximal environments, such as the family and local community, in shaping children's perceptions of disaster risks.

The activities within the probe kit were designed to explore and reinforce household communication in varying degrees. For instance, the detective role-playing game included interview templates that encouraged participants to engage family members in discussions about disasters and preparedness strategies. The goal of this activity was to spark conversation within households, enabling the sharing of knowledge and experiences about disasters and disaster risks. As noted in previous studies, structured family activities like these are effective in fostering a culture of preparedness and resilience within households (Ronan et al., 2015b).

Throughout the booklet, participant inputs and answers in several activities, such as the diary and detective role-play game, provided evidence of meaningful and reflective conversations within families. In particular, the detective role-play game saw most participants interview their parents, asking them questions about disasters and how the family could be better prepared. In another activity, the disaster board game, participants were prompted to engage in hypothetical disaster scenarios and consider what their immediate actions would be, such as who they would contact in an emergency. Most participants responded by saying they would reach out to emergency services or their parents, highlighting the central role family communication plays in their disaster preparedness mindset. At the end of the activity, participants reflected on their key takeaways, with one participant noting:

"An idea that me and my mum came up with is to be extra prepared for emergencies. It is having a waterproof kit with

important things in it. The most important lesson I picked up was to listen and look at my surroundings if a disaster occurs."
(Booklet Disaster Board Game, Participant #7)

This response, amongst many others, illustrates how the booklet facilitated effective communication between participants and their family members, encouraging them to reflect on and develop practical disaster-preparedness solutions. The impact of the probe activities on household communications towards DRR became even more evident when comparing participants' responses from pre- and post-test interviews. The post-test responses indicated that participants had an increased sense of communication and connection with their families within the context of disaster preparedness. These conversations had a direct impact on their understanding of disaster risk mitigation. Many participants referenced discussions they had with family members as influential in shaping their preparedness strategies. When asked in the post-test interview, "What do you think are some of the things we could do to be more prepared for disasters?"

"Um, for example, if something happened, we should have a plan. Like an emergency plan. If there's a tsunami, we go to higher ground; if there's a fire, we'd go to the top of the driveway." (Post-test Interview, Participant #14)

This response directly relates back to the participant's answers in the booklet, mirroring the conversations that were sparked between family members. Similarly, another participant #7, noted:

"I'm pretty sure I said this in the book, but me and my mom created this thing where if there was a flood or something, or something where we'd need to leave the house, we have this waterproof box that has our passport and things. I think people

could make those. That would be an awesome way to be more prepared." (Participant #7)

These responses highlight the increase in communication within households as a result of the interactions with the probe activities. Participants not only engaged in discussions about disaster preparedness but also took steps to create practical solutions, such as the waterproof emergency kit. This demonstrates the potential of household communication to enhance both individual and collective resilience, contributing to the creation of more disaster-resilient communities.

Household and Community Experiences and Preparedness emphasise the critical role that learning from others' past experiences with disasters plays in fostering resilience at both individual and community levels. This concept is particularly relevant for children, especially younger ones, who may not have personal experiences with disasters due to their age. However, by engaging with the experiences of others, including family members, friends, and community members, children can absorb valuable lessons about disaster preparedness, mitigation strategies, and resilience. Research spanning the last two decades has consistently highlighted the importance of intergenerational knowledge sharing, especially in the context of DRR. Earlier studies, such as Pearce (2003), emphasised that individuals and communities who learn from past events are better equipped to handle future crises by adopting proven strategies and avoiding past mistakes. All the way to more recent studies, that reaffirm this, showing that communities that engage in knowledge-sharing practices build stronger social networks, which are key to effective disaster response and recovery (Prime et al., 2023). Children, due to their limited direct experiences, particularly benefit from understanding how their parents, relatives, or other community members have dealt with disasters. This helps them form a mental model of how to act during emergencies, contributing to the overall preparedness of the household. The process of learning from others'

experiences has been shown to be a powerful educational tool in DRR, allowing children to connect theoretical knowledge with real-life practices tested in past events (Peek & Fothergill, 2008; Ronan et al., 2015a).

In this study, Household and Community Experiences were explored through a series of interview questions and activity prompts embedded in the probe kit. This provided participants with opportunities to reflect on both their own and their family's encounters with disasters. It also allowed researchers to gain insights into participants' interpretations of what constitutes a "disaster." When asked in pre-test interviews whether they or someone they knew had experienced a disaster, responses varied, reflecting different levels of understanding and awareness. Some participants cited the global COVID-19 pandemic as a disaster, while others mentioned family members who had been through other disasters, such as earthquakes and hurricanes. These responses illustrate a baseline awareness shaped by both personal and indirect experiences of disaster. For example, one participant described their parent's experience of earthquakes and cyclones, noting the advice given:

"Be prepared, identify risks and things we can do to reduce them. Make plans together for what we will do in an emergency." (Booklet Detective Role-Play Game, Participant #17)

This response highlights how parents' experiences with multiple disasters have shaped their preparedness mindset, which is passed on to their children. The focus on risk identification and joint planning reflects established best practices in disaster preparedness, aligning with the Sendai Framework's emphasis on inclusive, family-based planning processes as a means to build resilience at the household level (UNDRR, 2015; Walsh et al., 2020).

The Detective Role-Play Game within the booklet was particularly effective in prompting participants to engage with their family members about their disaster experiences. In this activity, participants interviewed their parents or relatives to learn how they had dealt with disasters in the past and how they mitigated associated risks. This exercise fostered valuable dialogue, encouraging participants to draw connections between their family's past experiences and their own preparedness actions. Another participant documented their parent's insights on preparedness: *"Be informed. I have an emergency pack that has things like canned food and spare clothes."* (Booklet Detective Role-Play Game, Participant #7)

Other participants echoed similar sentiments, illustrating the recurring theme of family members passing down practical preparedness advice based on their lived experiences: *"Be aware of surroundings. Have an escape plan."* (Booklet Detective Role-Play Game, Participant #12), *"Have a safety kit ready, have a plan."* (Booklet Detective Role-Play Game, Participant #5)

These responses emphasise the value of sharing knowledge within households, particularly in terms of practical disaster preparedness measures. As families recount their experiences with past disasters, they convey a sense of responsibility and preparedness to the younger generation. This reinforces the notion that disaster preparedness is not only about understanding risks but also about actively engaging in practical measures to mitigate those risks. Households that engage in this type of intergenerational knowledge exchange are more likely to be resilient during disasters (Becker et al., 2012; Kapucu & Garayev, 2011). Furthermore, the process of documenting and reflecting on household disaster experiences in the post-test interviews revealed an increased awareness among participants of the importance of preparedness. These discussions prompted participants to internalise the lessons learned from their family members' experiences and apply them to their own understanding of disaster risk reduction. This is consistent with findings by Peek and Fothergill

(Peek & Fothergill, 2008), who explored how family discussions about disaster experiences can influence children's risk perceptions and foster greater preparedness.

5.3.3. THEME 3: FUTURE SCENARIOS AND SOLUTIONS

The theme of Future Scenarios and Solutions is directly inspired by the Sendai Framework's emphasis on preventive approaches and the concept of "building back better". While the theme was initially informed by these theoretical principles, it gained depth and practical relevance through the data, as participants reflected on potential future disasters and proposed proactive strategies during the probe activities and interviews. The framework stresses the importance of learning from past disasters to mitigate future risks by integrating resilience-building measures into preventive efforts (Busayo et al., 2020; Prime et al., 2023). This forward-looking perspective aligns with the speculative nature of Design Fiction, a design practice that encourages the exploration of possible futures to challenge current assumptions and promote discussions about potential future developments (Bleecker, 2022b; Coulton et al., 2017). Design Fiction provides a creative platform for imagining scenarios where future technologies, societal structures, or policies may emerge, making it a useful tool for addressing disaster resilience and risk reduction. The Time Capsule activity within the probe booklet is an embodiment of this theme, focusing on children's vision of the future through the lens of disaster preparedness.

This activity not only allows participants to imagine possible disaster scenarios in the future but also emphasises how today's actions can shape the disaster landscape of tomorrow. The inclusion of this activity aligns with research showing that engaging people in future-oriented thinking contributes to more effective disaster risk management. For example, scholars have demonstrated that scenario planning, particularly when applied to disaster preparedness, significantly enhances community resilience by fostering proactive strategies

and long-term thinking (Daniel Ralph et al., 2020; Pearce, 2003; Ronan et al., 2015a). The Time Capsule activity prompts participants to think critically about what might happen in the future and what actions could mitigate potential risks. The theme of Future Scenarios and Solutions is grounded in two main underlying codes: Future-Oriented Thinking and Future-Oriented Solutions.

Future-Oriented Thinking encourages children to reflect on potential disaster scenarios they might encounter and to anticipate the challenges these situations may pose. This forward-thinking approach fosters a mindset that prioritises preparedness, which is central to disaster risk reduction (DRR) efforts and aligns with the Sendai Framework's goal of enhancing individual and community resilience. The Sendai Framework emphasises the importance of forward-looking strategies to prevent and mitigate the impacts of disasters by engaging communities in preparedness efforts that are proactive and inclusive (UNDRR, 2015). Encouraging children to think critically about the future not only builds their capacity for resilience but also equips them with a better understanding of the risks that exist in their environment today and how these may evolve.

In the Time Capsule activity, participants were prompted to explore their present-day environment, their positionality, and the risks around them, which had been a focus in previous activities within the booklet. This reflection enabled participants to deepen their understanding of the resources and risks present in their environment. Through creative activities such as drawing and responding to exploratory questions, participants were asked to document how they envision the future, from their immediate surroundings to the wider city, specifically from a disaster preparedness perspective. This process allowed participants to further reflect on how they perceive future risks and explore how their current environment might transform in the face of these challenges.

By engaging with prior booklet activities, participants were better equipped to think critically about disaster risks and preparedness, as well as how these risks

might play out in the future. Research shows that activities encouraging future-oriented thinking can enhance children's understanding of disaster preparedness and promote proactive strategies for managing future risks (Daniel Ralph et al., 2020; Peek, 2008). The ability to link present conditions to future outcomes is essential in fostering a culture of disaster resilience, as children are encouraged to envision both the potential threats and the adaptive measures that could mitigate those threats.

Participant responses clearly demonstrated meaningful engagement with the booklet activities. Their answers reflected deep exploration and thoughtful reflection on disaster topics, as encouraged by earlier activities in the booklet. For example, one participant illustrated a futuristic city, noting that pollution was a significant risk to the future. When asked, "How do you think disasters will affect the future?" the participant responded:

"I think disasters will affect the future by affecting the environment more than it does now. Also, by affecting the people in the future by causing them to stay inside." (Booklet Time Capsule Activity, Participant #17).

This response illustrates the participant's engagement with the activity and highlights their understanding of environmental risks that could influence the future, demonstrating both imagination and a realistic view of how disaster impacts might unfold in their city (Figure 22).

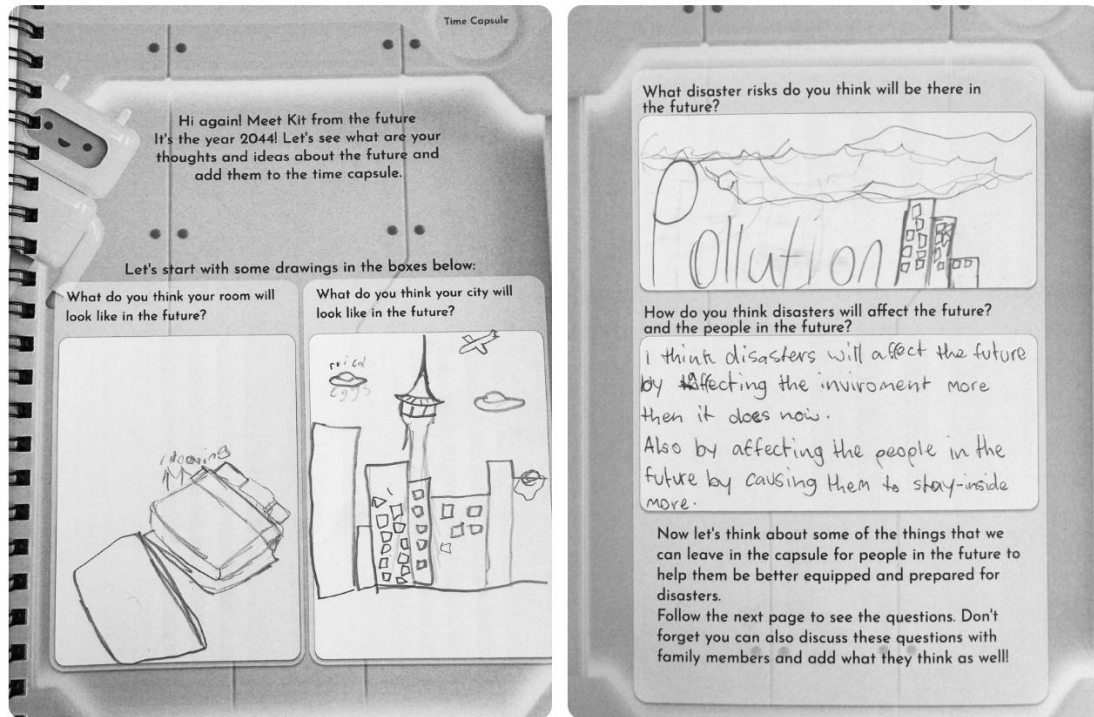


Figure 22. Pages from the Time Capsule activity, Participant #17

In another example, Participant #20 opted to write in the boxes rather than draw but provided thoughtful responses to the prompts. These responses showcased their creative and imaginative exploration of the future, reflecting their deep engagement with the probe activities. Participant #20's interactions with this part of the activity are shown in Figure 23.

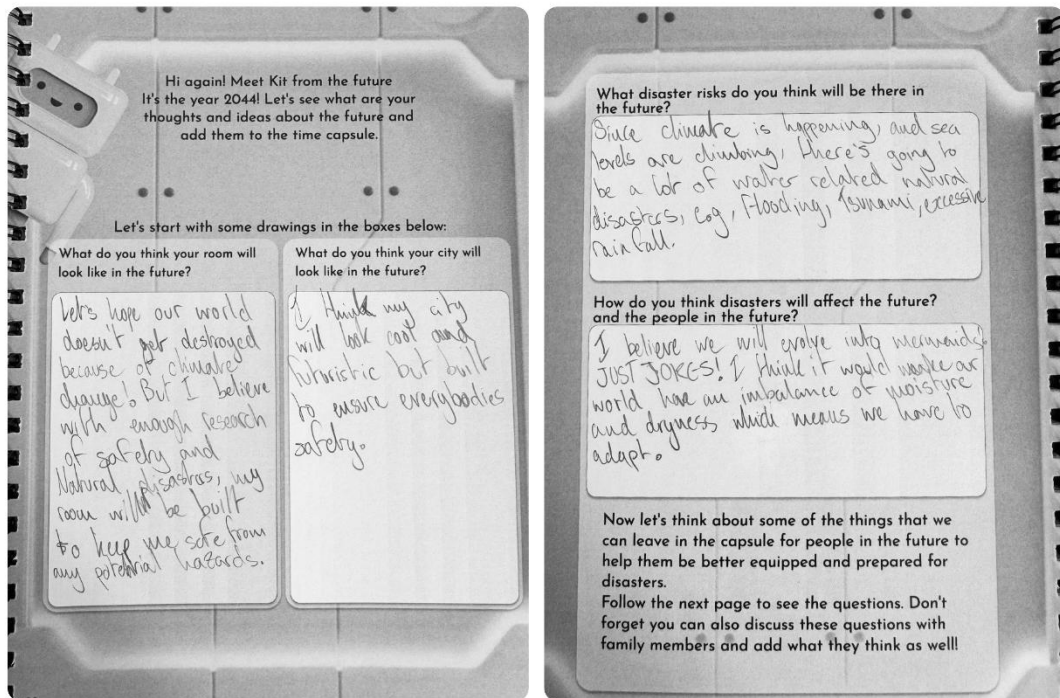


Figure 23. Pages from the Time Capsule activity, Participant #20

Participant #Jana reflected on how climate change might shape the future, specifically considering their environment, their room, and their city from a disaster lens. In response to the prompt about their city, the participant noted: *"Let's hope our world doesn't get destroyed because of climate change! But I believe with enough research on safety and natural disasters, my room will be built to keep me safe from any potential hazards."* (Booklet Time Capsule Activity, Participant #20). When asked about the future of their city, they further explained: *"I think my city will look cool and futuristic but built to ensure everybody's safety."* (Booklet Time Capsule Activity, Participant #20).

These responses reveal the participant's positive outlook on the environmental challenges ahead, emphasising safety and preparedness. Additionally, when asked what disaster risks they foresee in the future, Participant #Jana showcased their growing understanding of disaster risks by stating: *"Since climate is happening, and sea levels are climbing, there's going to be a lot of*

water-related natural disasters, e.g. flooding, tsunami, excessive rainfall." (Booklet Time Capsule Activity, Participant #20) When prompted to consider how disasters might affect the future and the people living in it, the participant responded with humour: *"I believe we will evolve into mermaids! JUST JOKES!"* (Booklet Time Capsule Activity, Participant #20). This humorous remark was followed by a more reflective answer: *"I think it would make our world have an imbalance of moisture and dryness, which means we have to adapt."* (Booklet Time Capsule Activity, Participant #20).

This answer not only reflects the participant's understanding of current and potentially future risks but also their recognition of the importance of adaptation to manage future disaster risks. By framing future scenarios in an imaginative yet grounded way, the participant illustrates how children can internalise complex environmental issues while maintaining a hopeful perspective on adaptation and resilience.

Future-Oriented Solutions refers to the ideas and strategies that children propose in response to their imagined future scenarios. These solutions, shaped by the participants' understanding of past and present risks, align with the Sendai Framework's priority of investing in disaster risk reduction (DRR) to build resilience and ensure that future generations are better prepared to manage disaster risks. The Sendai Framework emphasises that proactive measures, rather than reactive responses, are critical for reducing vulnerability and enhancing resilience in the face of disaster (J.-C. Gaillard & Mercer, 2013; UNDRR, 2015). This theme is explored in the Time Capsule activity, which encourages participants to envision future disaster scenarios and to think critically about the actions they can take today to mitigate future risks.

The Time Capsule activity serves as a platform for children to engage with forward-thinking strategies that address both current and future disaster risks. After imagining a future disaster scenario, participants are prompted to reflect

on the actions they can take to better equip themselves for future disasters. This exercise directly supports the Sendai Framework's call for educating and empowering individuals to take proactive roles in risk reduction, particularly the younger generation who will inherit and navigate future disaster challenges (Ronan et al., 2015a). Since the Time Capsule activity is the final task in the booklet, it offers a unique opportunity to gauge how previous activities have influenced the participants' understanding of DRR. By this point, participants have engaged with a series of exploratory prompts and activities designed to build their awareness of disaster risks and preparedness. The Future-Oriented Solutions code is explored through questions that not only encourage participants to imagine the future but also require them to reflect on and summarise what they have learned throughout the booklet. In the context of DRR, this reflection helps solidify the idea that human actions play a critical role in shaping disaster outcomes.

For example, when participants were asked, "*What do you think we can do to have a world without disasters?*", many participants thoughtfully recognised the impossibility of a disaster-free world. However, their responses also revealed an understanding that, while disasters may be inevitable, we can still take meaningful steps to mitigate risks and reduce the severity of their impacts. This shift in perspective, from viewing disasters as uncontrollable events to understanding that proactive actions can make a difference, demonstrates the impact of the booklet's activities in fostering a more empowered mindset. Some notable responses include:

"It's impossible to have a world without disasters but probably become aware of the things we use and do." (Booklet Time Capsule Activity, Participant #2), "Mostly we can care more about our surroundings and things that can happen." (Booklet Time Capsule Activity, Participant #7), "We NEED to stop

treating our planet like trash!" (Booklet Time Capsule Activity, Participant #20).

These responses clearly mirror the influence of the previous activities, shaping participants' understanding of disaster risks and their role in mitigating those risks. This engagement aligns with research suggesting that educating individuals, especially children, about DRR promotes a sense of agency and responsibility, empowering them to take actions that contribute to building resilience (Paton & Johnston, 2001; Ronan et al., 2016).

The final question in this activity asks participants, "What is one key message you would leave for the people in the future?" This prompt encourages participants to distil their newfound understanding of DRR into a single message, reflecting their enhanced awareness of both existing disaster risks and the importance of human action in preventing and mitigating those risks. Some thoughtful responses included: *"I hope we have made a better and safer world."* (Participant #2), *"Plan and be organised for any disasters."* (Participant #8), *"Look after our planet."* (Participant #9).

These answers highlight the participants' growing understanding of the importance of resilience, planning, and environmental safekeeping. The fact that they are now able to articulate key messages about disaster preparedness and mitigation demonstrates that the probe activities have effectively shifted their perspectives. Participants are no longer passive observers of disaster risk; they have become proactive thinkers, aware of the actions they can take to create a safer and more resilient future. The Future-Oriented Solutions theme reflects how children, through thoughtful engagement with the activities, have internalised key DRR principles. Their responses demonstrate a strong awareness of the human capacity to mitigate disaster risks and the importance of taking proactive steps to ensure a resilient future. This is in line with the Sendai Framework's goals of empowering communities to reduce disaster risk and

enhancing resilience, especially among younger generations who will play a pivotal role in shaping future DRR efforts (J.-C. Gaillard & Mercer, 2013; UNDRR, 2015).

5.3.4. THEME 4: KNOWLEDGE AND RESILIENCE

The theme of Knowledge and Resilience explores the participants' understanding of disasters, focusing on how their knowledge is shaped or improved over time, particularly through interactions with the probe activities. This theme is grounded in the idea that individuals' knowledge about what disasters are, how they occur, and the preparedness measures that can be taken significantly influences their perceptions of disaster risks. A deeper understanding of these factors can positively impact how well-prepared individuals and communities are for future disasters. The concept of resilience in this context refers not only to participants' knowledge of disasters but also to their level of preparedness and their overall understanding of resilience, how well they are equipped to handle disaster risks. Resilience is also influenced by prior experiences with disasters, which can play a pivotal role in shaping an individual's ability to respond to future risks (J.-C. Gaillard & Mercer, 2013; Paton & Johnston, 2001).

This theme consists of two underlying codes: Knowledge of Disasters and Preparedness Measures and Personal Experiences with Disasters. Both areas are key in determining how well-prepared individuals and communities are when facing disasters. Research suggests that a solid foundation of disaster knowledge can have a profound effect on actions taken before, during, and after disaster events, directly contributing to increased resilience (Becker et al., 2012; Paton & Johnston, 2001).

The code Knowledge of Disasters and Preparedness Measures was explored through various probe activities and interview questions. Many studies underscore the idea that even basic knowledge can significantly improve

disaster preparedness and resilience at the individual and community levels. For example, a study by Ronan et al. (2016) emphasises that educating children and communities about disasters leads to better-prepared individuals who can take proactive steps to reduce risk. This principle was reflected in the probe activities, where participants engaged in exercises designed to deepen their understanding of disasters.

In comparing the pre- and post-test interviews, it became evident that participants' understanding of disasters developed significantly after interacting with the booklet. Initially, participants had varied perceptions of what disasters are and how they occur. However, the booklet's activities, particularly the Flowchart of How Disasters Are Created, encouraged participants to explore how both natural phenomena and human actions can combine to create disaster scenarios. This activity prompted participants to reflect on the role of human behaviour in either reducing or exacerbating disaster risks, reinforcing the idea that individuals play an active role in disaster mitigation. Figure 24 shows the flowchart with answers filled by participant #9, who has interestingly written "war" for disastrous human action. Other participants also provided thoughtful examples of human involvement in disasters, demonstrating their existing knowledge of how disasters arise. They cited issues such as air pollution, nuclear explosions, and war as man-made contributors to disaster scenarios. These examples show that participants had a foundational understanding of the different factors that can cause disasters. When asked how they define disasters, one participant explained:

"Disaster, I think, evokes a feeling of tragedy, something tragic. And it can range in size. So, like something small, like spilling a birthday cake could be a disaster, but also a disaster could be something that could kill a lot of people, just anything tragic."
(Pre-test interview – Participant #17)

This response reveals a broad interpretation of disasters, ranging from personal mishaps to large-scale tragic events. After engaging with the booklet's activities, participants' understanding of disasters evolved, particularly regarding the human role in creating disasters.

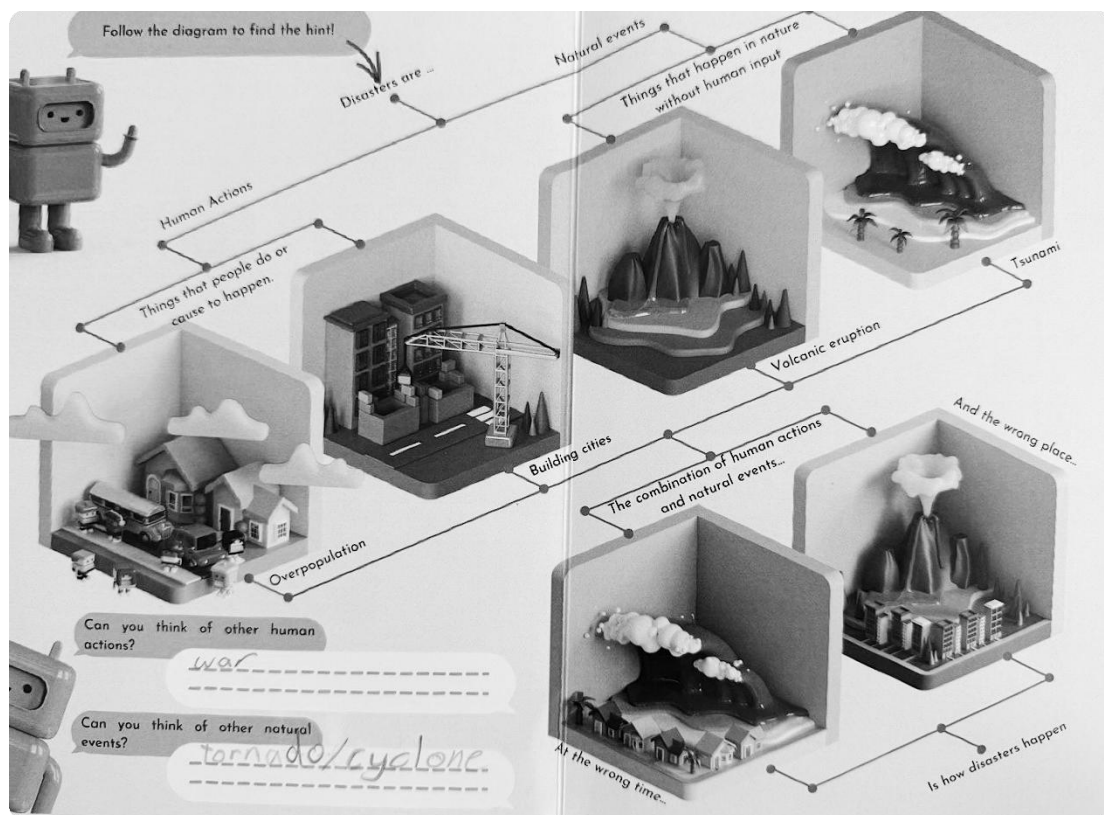


Figure 24. Example of the flowchart activity filled out by Participant #9

The post-test interviews reflected a marked shift in participants' views. While many initially saw disasters as purely natural occurrences, they came to realise the significant role human actions play in contributing to disaster risks. For example, when asked in the post-test interview about their current understanding of disasters, one participant shared:

"I feel like now that I look more into it, these disasters are caused by us. Like, you know, natural earth things are actually caused by us and what we've done to our Earth. It's not caused

by like, the natural earth. I don't think the Earth would ever do that to itself. But, like, yeah, we're pretty much causing Earth to, you know? And I don't know, but yeah, the disasters that are happening are all caused because of us and because of how we don't take care of our Earth.” (Post-test Interview, Participant #20)

This response reflects a deepened understanding of how human actions contribute to disaster risks, highlighting the critical realisation that disasters are not solely natural events but can be exacerbated by human behaviour. This aligns with one of the key goals of the theme: to foster an awareness of the human role in disaster creation and management. Studies show that gaining this kind of knowledge can inspire meaningful actions toward disaster risk reduction (DRR). A well-informed population is more likely to engage in proactive risk mitigation strategies, which can significantly reduce disaster impacts (Paton, 2019a; UNDRR, 2015).

The code of **Personal Experiences with Disasters** provides a valuable lens through which exploring participants' previous encounters with disaster events becomes possible. It also serves as an opportunity to understand how participants define disasters, linking this understanding to the theme of Awareness and Education, particularly the underlying code of Risk Perception. Going beyond that, understanding how participants view disasters is critical because personal experiences often shape individuals' and communities' preparedness levels and responses to future disasters. Research has consistently shown that people who have lived through disasters tend to adopt more effective preparedness measures, using lessons learned from their experiences to adjust their approach to future disasters (Becker et al., 2012; Lindell, 2018; Paton, 2017).

Having previously experienced disaster events can have a high impact on one's preparedness by fostering a heightened awareness of risks and the need for resilience. These experiences prompt individuals to take proactive steps to mitigate future risks by enhancing their disaster planning and preparedness strategies. For example, those who have experienced floods may be more likely to implement flood prevention measures, while those who have lived through earthquakes may focus on securing their homes and preparing emergency kits (J.-C. Gaillard & Mercer, 2013; Prime et al., 2023). This code offers insight into how participants reflect on their past disaster experiences, what lessons they learned, and how they plan to approach future disaster risks.

One of the key questions in the pre-test interview was, *"Have you or your family ever been in a disaster?"* This question was designed to initiate discussions about participants' personal experiences with disasters and to understand their definitions of what constitutes a disaster. Some participants indicated that they had not directly experienced disasters, while others cited global events like the COVID-19 pandemic. A significant number of participants referenced the severe floods that occurred in Auckland in 2023.

"Auckland Cyclone 2023. In the summer of 2023 we had just moved to Auckland and we were living with my grandparents. Their whole basement flooded." (Pre-test Interview, Participant #10)

This response illustrates the participant's personal experience with the event and highlights the immediate impact of the 2023 Auckland floods. Such experiences often leave a lasting impression on individuals, influencing their preparedness behaviours and risk perceptions. Studies show that individuals who have lived through disasters tend to be more vigilant about preparing for future risks, often making changes to their environment or behaviour based on past lessons (Esterwood & Saeed, 2020; Kato, 2021).

The exploration of previous experiences with disasters is further developed in other probe activities, such as the Detective Role-Playing Game, where participants explore their family members' experiences with disasters. In this activity, participants interview their parents or relatives about their understanding of and responses to past disasters. These discussions aimed to encourage participants to reflect on their families' experiences and to think critically about how these experiences have shaped their understanding of disaster preparedness. This insight is closely linked to the broader objective of exploring how learning translates into action and family engagement. By investigating past events, participants were able to connect personal experiences with future risk reduction strategies (Hoffmann & Muttarak, 2017; Kato, 2021). Many participants who mentioned the 2023 Auckland floods in the pre-test interviews continued to reference these floods in the detective activity. Floods and water-related disasters became central themes in their discussions about disaster risks. When asked to propose solutions for mitigating these risks, participants suggested practical actions such as preparing waterproof emergency kits, ensuring access to higher ground, and building homes on elevated land. These responses demonstrate how reflecting on personal disaster experiences helps participants think critically about both immediate and long-term solutions for disaster preparedness.

This connection between personal experience and future preparedness is well-documented in research. Many researchers have found that reflecting on past disaster events, such as floods, earthquakes or pandemics, leads to increased resilience, as individuals and communities are more likely to take proactive steps to mitigate future risks emphasising that learning from personal disaster experiences promotes a culture of preparedness, helping communities better anticipate and respond to future risks (Esterwood & Saeed, 2020; Leng et al., 2020; Sattler et al., 2000). Moreover, personal experiences with disasters not only capture participants' direct experiences but also explore how these

experiences shape their understanding of disaster risks and their preparedness strategies. The 2023 Auckland floods, for instance, provided a tangible example that participants used to inform their responses to future disaster scenarios. By reflecting on past experiences, participants engaged in critical thinking about future disaster preparedness, demonstrating an awareness of both short-term actions and long-term strategies to reduce disaster risks. This reflection plays a crucial role in fostering resilience at both the individual and community levels, aligning with the broader goals of DRR.

5.3.5. THEME 5: VULNERABILITY-FOCUSED DISASTER RESPONSE AND SUPPORT

The theme of Vulnerability-Focused Disaster Response and Support centres on the critical concept of vulnerability, which has been extensively explored in DRR literature and has become a major focus within the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015). In this research, vulnerability is primarily examined through the lens of children, a group often considered as a particularly vulnerable group in the face of disasters. However, rather than viewing children solely as victims, this research embraces the idea of children as active agents of change in disaster preparedness and response. By empowering children and encouraging them to explore the concept of vulnerability, the research seeks to enhance their understanding and involvement in addressing vulnerability in disaster contexts.

This theme was investigated through two underlying codes: Perception of Vulnerability and Addressing Vulnerability, Reflections, and Support. These codes aimed to capture participants' evolving understanding of vulnerability and how they believe it can be addressed within their communities. The inclusion of these codes reflects the broader goals of DRR, which emphasise that building a less vulnerable community significantly increases its ability to recover and "bounce back" after disaster events (Le Masson, 2015; Lindell, 2018).

One of the primary motivations behind exploring vulnerability as a central theme in this research was the wealth of DRR literature that highlights the importance of reducing vulnerability as a core component of disaster resilience. Research has consistently shown that when communities are less vulnerable, whether due to improved infrastructure, better preparedness, or more equitable support systems, their capacity to respond to and recover from disasters is greatly enhanced (Cutter et al., 2016; J.-C. Gaillard, 2019). This aligns with the Sendai Framework's emphasis on identifying and addressing the vulnerabilities of specific groups, including children, the elderly, and those with disabilities, to create more resilient communities. By focusing on children's perceptions of vulnerability and encouraging them to reflect on the support systems needed to address these vulnerabilities, the research not only aimed to deepen their understanding but also sought to empower them as active contributors to disaster response and preparedness efforts. Through this exploration, participants were able to reflect on their own vulnerabilities as well as the vulnerabilities of others in their communities, fostering a more inclusive and supportive approach to disaster risk reduction.

Perception of Vulnerability was explored throughout the data-gathering process, starting with the pre- and post-test interviews and continuing into the various booklet activities. This code aimed to capture participants' understandings of vulnerability and how their perspectives may have changed after interacting with the probe kit. The comparison between pre- and post-test interview responses, along with analysis of answers provided in the booklet, highlights the effectiveness of the probe activities in deepening participants' reflections on vulnerability. These activities prompted participants to explore the concept of vulnerability more deeply, helping them to develop a more nuanced understanding.

To begin, the pre-test interview included the question, "*Who do you think disasters affect the most?*". This question served as a starting point for exploring

participants' initial perceptions of vulnerability. Conversations with friends and family, prompted by the Detective Role-playing Game, further expanded this exploration, allowing participants to hear different perspectives and think more critically about vulnerability. Additionally, the Disaster Board Game encouraged participants to imagine hypothetical disaster scenarios and propose solutions, prompting them to consider who they would help or save in such situations. By revisiting the same vulnerability-related question in the post-test interview, it was made possible to compare the pre-and post-test answers and draw conclusions about the impact of these probe activities on participants' evolving perceptions of vulnerability.

In the pre-test interviews, many participants had a basic understanding of vulnerability, with some mentioning young children and the elderly as groups most affected by disasters. However, other responses did not reflect much depth regarding the concept of vulnerability. This shifted significantly in the post-test interviews and through the probe activities. The activities fostered more critical thinking through initiating conversations and motivation to further explore and reflect, leading participants to a deeper understanding of who is most vulnerable in disaster situations and why. For instance, in the Disaster Board Game, participants noted:

"An important lesson I have picked up is there are other people in need of help to get to safety so I have learnt to think about others too." (Booklet Disaster Board Game, Participant #20). "I learnt that you have to save yourself first and then help other people and pets." (Booklet Disaster Board Game, Participant #8).

Both these responses indicate that participants, after engaging with the booklet activities, had started to develop a broader awareness of vulnerability, acknowledging the needs of younger children and the elderly while also learning

to balance self-care with helping others. In the post-test interviews, participants demonstrated a more profound understanding of vulnerability, with one participant elaborating on the condition of homeless people during disasters:

"I think people that live on the streets, because they won't have like a house to escape to or anywhere safe. But like, the people in the streets wouldn't have anyone to go to..." (Post-test Interview, Participant #19).

This response highlights the participant's growing awareness of how disasters impact different populations, particularly vulnerable groups such as the homeless. Over the course of the probe activities, participants began to demonstrate a much deeper understanding of vulnerability. By the time of the post-test interviews, many had moved beyond their initial, basic notions to provide more insightful and nuanced reflections on the complexities of disaster vulnerability. Participants increasingly recognised a wide range of vulnerable groups, including young children, the elderly, individuals with health conditions, people with disabilities, and the homeless, as being particularly susceptible in disaster scenarios. The discussions also revealed that participants had begun to understand the broader social factors that contribute to vulnerability. For example, several noted that people who live in disaster-prone areas, those with limited mobility, and those without the financial means to evacuate quickly are often the hardest hit by disasters. This reflects a growing awareness of the social and economic inequalities that can exacerbate disaster impacts. One participant even offered the thoughtful observation: *"Poor people because they have weak bodies due to not having enough food and sleep."* (Booklet Questions, Participant #19).

Although expressed in simple terms by a 9-year-old, this response reveals a deep reflection on the intersection of poverty and vulnerability. The participant recognised that those who are economically disadvantaged are not only

physically weaker due to a lack of resources but are also less able to withstand the impacts of disasters. This is a significant and meaningful insight, reflecting an understanding that vulnerability is not only about physical location or immediate circumstances but is also shaped by broader systemic factors like poverty and access to basic needs.

These reflections reveal a notable shift in participants' depth of understanding. Prior research has shown that recognising vulnerability is a crucial step in addressing challenges faced by vulnerable groups during disasters. By identifying and understanding these vulnerabilities, it becomes easier to develop targeted solutions that address the specific needs of those most at risk, ultimately contributing to more effective DRR (Le Masson, 2015; Lindell, 2018). The comparison of pre- and post-test interviews and booklet activities demonstrate a clear progression in participants' understanding of vulnerability. Initially, many participants had a surface-level understanding, often limited to young and elderly populations. However, through the probe activities, their perspectives deepened significantly, encompassing a broader range of vulnerable groups and recognising the importance of addressing these vulnerabilities in future disaster preparedness efforts. This shift underscores the effectiveness of the activities in fostering critical thinking about vulnerability and demonstrates how enhanced awareness can lead to better outcomes in DRR strategies (Abbas & Guo, 2023; UNDRR, 2015).

Addressing Vulnerability, Reflections, and Support delves into the potential solutions and support strategies that participants would offer in the context of disaster risk reduction (DRR). This exploration is centred on their imaginative and reflective perspectives towards DRR, building upon the insights gained from the previous code, Perceptions of Vulnerability. While the earlier focus was on identifying and critically thinking about vulnerable populations, this code shifts towards addressing these vulnerabilities by reflecting on how support can be provided. According to the Sendai Framework and numerous research studies,

understanding vulnerability is recognised as the crucial first step. However, resilience is achieved by moving forward to actively address vulnerabilities, which strengthens the capacity of societies and communities to withstand and recover from disasters (Lindell, 2018; UNDRR, 2015).

This code was explored through questions and activity prompts embedded throughout the interviews and probe activities. In the pre-test interviews, participants often shared responses that reflected a basic understanding of helping others in times of disaster, but these answers generally lacked depth. Many participants demonstrated limited awareness of what vulnerability entails and were uncertain about how to address it. For instance, when asked, "How do you think we can help ourselves and others in time of a disaster?", the responses were often focused on general disaster drills learned in school, such as hiding under a table. Some participants admitted they did not know exactly what to do in a disaster scenario. For example, one participant candidly stated: *"I mean, we can help. I just don't know how."* (Pre-test Interview, Participant #12).

This response, along with many others, reflected a lack of engagement and motivation, as well as a shallow understanding of disaster preparedness, particularly in relation to supporting vulnerable groups. Many participants could only articulate basic actions they had learned in school, and the lack of more meaningful reflection highlighted their limited perspective on DRR measures. This gap in understanding was addressed through the booklet activities, where participants were encouraged to think more deeply about vulnerability and how to support others.

The probe activities, such as the Detective Role-Play Game, the Disaster Board Game, and the Time Capsule Activity, were designed to engage participants more meaningfully with these topics, initiating deeper reflection and exploration. These activities prompted participants to think critically about the various ways they could address vulnerability in disaster scenarios, whether by providing

support to others, sharing resources, or reflecting on their role as active agents of change. The aim was to broaden participants' understanding of how they could contribute to DRR efforts by addressing the needs of the most vulnerable.

This deeper exploration proved to be effective. By the time participants engaged with the activity prompts and reflected on vulnerability, their responses had become more thoughtful and nuanced. Many participants moved beyond their initial, surface-level answers and demonstrated a greater depth of understanding regarding how to support vulnerable populations and act as agents of change during a disaster. For instance, in the closing part of the Detective Role-Play Game, participants were prompted to reflect on the lessons they had learned from the activity.

"Be aware of hazards around us and where we can go for safety, like under a desk or table, up a mountain or any high grounds. Make sure old people or young kids/Babies can get to safety but make sure I'm safe first." (Booklet Disaster Board Game, Participant #9).

This response shows a significant progression in the participant's understanding of vulnerability. The participant not only acknowledges the importance of protecting others, such as children and the elderly but also recognises the necessity of securing their own safety first to be in a position to help others effectively. This layered approach to addressing vulnerability reflects a growing awareness of the complexities involved in DRR, where helping oneself is not seen as selfish but as a prerequisite to being able to help others. The participant's reference to prioritising safety while ensuring the well-being of vulnerable groups, such as young children and the elderly, highlights a more sophisticated and comprehensive understanding of disaster response.

Moreover, the evolution from pre-test to post-test interviews shows the increased depth of participants' reflections on how they can address vulnerability. Where they initially struggled to think beyond basic actions, their later responses incorporated more active and reflective strategies, such as ensuring others' safety, being mindful of their surroundings, and understanding the broader context of vulnerability in disasters. This transformation aligns with the broader goals of the Sendai Framework, which emphasises that fostering a more inclusive and engaged mindset in DRR leads to more resilient communities (Cutter et al., 2016; Gaillard, 2019). The code of Addressing Vulnerability, Reflections, and Support captures the progression of participants' understanding from basic disaster preparedness to a more thoughtful consideration of how to support others and address vulnerability. The probe activities effectively deepened participants' awareness of their role in disaster response, encouraging them to reflect on not only their own safety but also the well-being of others. This shift towards a more active and engaged approach to DRR highlights the importance of empowering individuals, especially children, to think critically about vulnerability and resilience in disaster scenarios.

5.3.6. THEMATIC ANALYSIS SUMMARY

The thematic analysis of the inputs provided by participants captures how participants' understanding of disaster risk reduction (DRR) developed through the various probe activities, highlighting five main themes that emerged during the analysis. The first theme, Disaster Awareness and Risk Assessment, explores how participants became better at spotting potential risks around them and thinking critically about disasters. Initially, many saw disasters as distant or abstract, but after engaging with the probe activities, they began identifying real risks in their surroundings, like fire hazards or flooding. The findings suggest that the probes were effective in encouraging participants to engage with DRR concepts in a more interactive and reflective manner. Rather than simply receiving information, participants were guided through a process of self-directed exploration, enabling them to unpack and understand complex disaster-

related issues. This shift in thinking, from vague ideas about disasters to a more practical, everyday awareness of risks, was evident in their responses, particularly in their ability to identify and discuss hazards within their own environments. Such engagement is a crucial step in fostering disaster preparedness.

The second theme, Community and Household Level Involvement and Relationships focused on how family and community dynamics play a key role in preparing for disasters. Through activities that encouraged conversations with family members, participants learned more about how others had handled disasters in the past and came up with practical ideas for being better prepared, like creating emergency kits. This theme highlights the importance of family discussions in building a collective sense of preparedness and resilience. The third theme, Future Scenarios and Solutions encouraged participants to imagine future disasters and think about solutions. The Time Capsule Activity helped participants reflect on how today's actions can influence future disaster outcomes. They came up with creative ideas, like designing stronger homes or using technology to improve disaster response. This theme really tapped into their imagination, showing how forward-thinking can help shape more resilient communities.

The fourth theme, Knowledge and Resilience, highlights how participants' understanding of disaster risks grew over time. Many began by seeing disasters as uncontrollable events, but after the probe activities, they started to recognise that human actions can play a big part in causing or preventing disasters. This theme shows how knowledge and awareness, combined with personal experiences, can lead to better preparedness and resilience. Finally, the theme Vulnerability-Focused Disaster Response and Support dives into participants' reflections on who is most vulnerable during disasters and how to support them. At first, their understanding of vulnerability was quite basic, but through the activities, they began to think more deeply about groups like children, the

elderly, and people with disabilities. By the end, participants had a much clearer idea of how disasters impact different groups and how we can work together to offer better support.

Overall, these themes show a clear progression in how participants thought about disaster risks, preparedness, and helping vulnerable groups. The probe activities effectively engaged them, encouraging not just critical thinking but also empathy, creativity, and a sense of responsibility in building more resilient communities, all worthwhile contributors towards DRR.

5.4. KEY INSIGHTS: CAPACITY OF PROBES TO FOSTER DISASTER LEARNING

The analysis presented in this chapter highlights the potential that design probes hold in fostering disaster learning, particularly when tailored to the developmental stages, interests, and cognitive capacities of the target age group. Drawing from the themes and codes identified earlier, it becomes clear that the design and implementation of the probe activities effectively engaged participants, promoted critical thinking, and facilitated meaningful learning about DRR concepts and efforts.

One significant takeaway from the thematic analysis is the importance of effectively aligning probe activities with the needs and capacities of the participants. As highlighted in the themes of *disaster awareness and risk assessment*, and *knowledge and resilience*, the activities successfully captured children's natural curiosity and sense of exploration. For instance, the Detective Role-Playing Game encouraged participants to investigate their surroundings, identify potential risks, and reflect on actionable strategies for disaster preparedness. These activities not only captured their attention but also prompted deeper cognitive engagement, fostering a proactive mindset towards disaster awareness. This suggests that well-designed probes can act as powerful catalysts for disaster learning by bridging the gap between theoretical knowledge and practical application.

Additionally, the probes' ability to foster critical thinking was evident across multiple themes, particularly in *Future scenarios and solutions* and *Vulnerability-focused disaster response and support*. Activities such as the Time Capsule and Disaster Board Game invited participants to envision hypothetical disaster scenarios and explore innovative solutions, prompting them to think beyond immediate risks and consider long-term resilience strategies. This forward-thinking approach deepened participants' understanding of disaster risks and nurtured a sense of agency, empowering them to see themselves as active contributors to disaster preparedness. Moreover, the reflective nature of these activities encouraged participants to critically evaluate their surroundings and consider broader social and environmental factors influencing disaster vulnerability. For example, participants' reflections on issues such as poverty, homelessness, and climate change revealed a refined understanding of vulnerability, demonstrating the probes' capacity to foster empathy and social awareness.

Furthermore, the role of probes in promoting collaborative learning and fostering connections between individual experiences and broader social contexts cannot be overlooked. As seen in *Community and household-level involvement and relationships*, activities like the Detective Role-Playing Game encouraged participants to engage with family members and community networks, sparking valuable conversations about disaster preparedness. These interactions not only enhanced participants' understanding of shared responsibilities in DRR but also highlighted the value of intergenerational knowledge exchange in building resilience. By prompting participants to draw on their own experiences and those of their families and communities, the probes bridged the gap between abstract concepts and lived realities, aligning with Bronfenbrenner's Ecological Systems Theory, which emphasises the influence of immediate and broader environments on children's development.

Building on these observations, the themes and codes discussed throughout this chapter provide strong justification for leveraging the capacity of probes to foster disaster learning. The success of activities like the Detective Role-Playing Game and Time Capsule highlights the importance of incorporating interactive, hands-on tasks that resonate with the target audience. At the same time, the reflective components of these activities illustrate the value of encouraging participants to think critically about their own environments and experiences, as well as the broader social factors influencing disaster risks. The emphasis on collaboration and contextual learning further points out the need to design probes that facilitate meaningful interactions between participants and their families, communities, and environments, contributing to a deeper understanding of DRR. Overall, the design probes in this study demonstrated their capacity to enhance participants' understandings, promote critical thinking, and empower them as learners to take an active role in disaster preparedness.


5.5. CHAPTER SUMMARY

This chapter provides a detailed thematic analysis of participant input and data, which revealed their evolving understanding of DRR concepts through their engagement with the probe activities and interviews. It responds to the limited evidence on how child-focused DRR activities can shift understanding over time by examining what kinds of learning and reflection actually emerged in practice. Through this analysis, the themes evolved further and eventually came down to five key themes: disaster awareness and risk assessment; community and household-level involvement and relationships; knowledge and resilience; future scenarios and solutions; *and vulnerability-focused disaster response and support*. These themes highlighted how the probes effectively fostered critical thinking, curiosity, and reflective engagement among participants, allowing them to connect theoretical concepts with practical, real-world applications.

Activities like the Detective Role-Playing Game and Time Capsule encouraged participants to identify risks, envision solutions, and explore the broader social factors influencing disaster vulnerability, showcasing their ability to think critically and empathetically about DRR. Taken together, these findings illustrate what aspects of the probe-based activities were most generative for learning, as well as where participants needed more scaffolding or clarification.

The analysis demonstrated the importance of aligning educational interventions with participants' developmental capacities, interests, and environments. The probes facilitated meaningful learning by engaging participants in hands-on, interactive tasks that resonated with their lived experiences. Themes such as Community and Household Level Involvement emphasised the value of family discussions in shaping collective preparedness, while Future Scenarios and Solutions revealed participants' capacity for creative problem-solving and forward-thinking.

Overall, the findings confirmed the impact that design probes can have in disaster education. By aiming to empower participants to reflect critically on their environments and envision inclusive strategies for DRR, the probes proved effective in nurturing the skills and perspectives necessary for building more disaster-resilient communities, and they point toward the value of future DRR initiatives that embed similarly participatory, reflective, and child-centred approaches.



*"Recognising the need is the primary condition
for design."*

– Charles Eames

CHAPTER 6 – FROM AWARENESS TO EMPOWERMENT: TRANSFORMING PERSPECTIVES ON DISASTER PREPAREDNESS

6.1. CHAPTER INTRODUCTION

This chapter examines the transformation in participants' understanding and engagement with DRR concepts that is facilitated by their interactions with the probe kit. The chapter builds on the findings from the previous analysis and shifts the focus towards evaluating how these heightened understandings translated into meaningful action. Central to this exploration is the comparative and impact analysis of pre- and post-test interviews, which uncovers how participants evolved in their comprehension of key themes such as *awareness and education, community and household involvement, future scenarios and solutions, knowledge and resilience, and vulnerability-focused disaster response*.

The chapter examines this evolution using a variety of analytical tools, including word clouds, heatmaps, radar charts, and sentiment analysis, to provide a deepened understanding of how the probe kit influenced participants' cognitive and emotional engagement with disaster-related concepts. The analysis reveals not only significant shifts in knowledge but also a deeper sense of responsibility, critical thinking, and an ability to propose creative solutions to disaster scenarios. Furthermore, this chapter delves into the emotional journey of participants as they gained confidence and positivity regarding their ability to manage disaster risks. Sentiment analysis demonstrates how the activities fostered not only intellectual growth but also emotional investment, empowering participants to take action. By examining both the cognitive and affective dimensions of learning, this chapter provides a comprehensive view of how the probe kit facilitated a shift from passive learning to active preparedness,

underscoring its potential as a transformative educational tool for disaster risk education.

6.2. COMPARATIVE AND IMPACT ANALYSIS: PRE-TEST VS POST-TEST INTERVIEW PERSPECTIVES

This section presents a comparative analysis of the themes extracted from the pre- and post-test interviews, focusing on the effect of the KIT activities on participants' perspectives. The purpose of this analysis is to evaluate how the children's views on DRR, preparedness, and vulnerability evolved after engaging with the probe kit during the study. The themes explored highlight the specific ways in which the activities influenced their thinking and understanding of these key concepts. By examining the shifts in themes between the pre-test and post-test interviews, the analysis reveals changes in participants' depth of knowledge, their sense of responsibility in disaster situations, and their ability to assess risks and propose solutions critically. While these comparisons highlight meaningful shifts, the chapter also recognises that not all change is uniform across participants or themes, and that some differences may reflect shifts in language and framing as much as fully consolidated understanding beyond the study context. For example, a word cloud analysis of participants' answers to the pre-test interview vs. the post-test interview reveals insights into shifts in the vocabulary used by participants. These word clouds reflect the most frequently mentioned words and concepts, highlighting how children's views on disaster-related topics evolved throughout their engagement with the KIT activities. In the pre-interview word cloud, Figure 25, terms like "school," "natural," "disaster," "tornadoes," and "tsunami" dominate, indicating that the children's initial thoughts were primarily focused on 'natural disasters' they had heard about, and possibly learned about, in school or other environments. Their understanding was largely shaped by conventional disaster types, with a focus on large-scale, often destructive events.

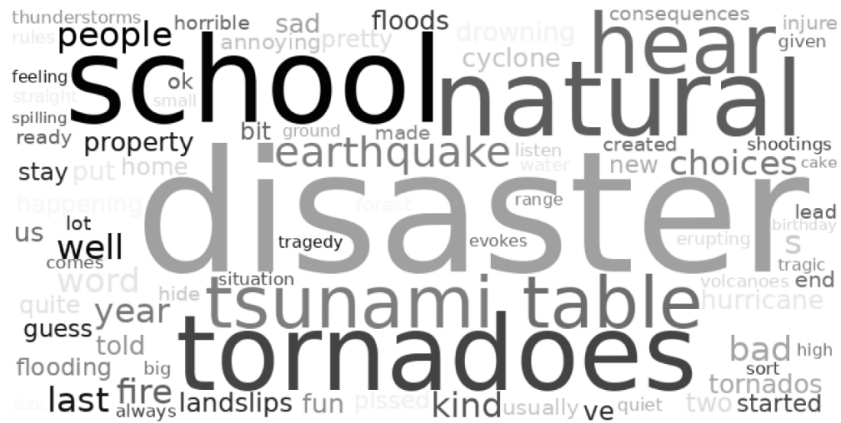


Figure 25. Pre-test interviews word cloud

By contrast, the post-interview word cloud in Figure 26 shows a marked shift in the participants' language and perceptions. Words like "disaster," "natural," and "human" still feature prominently, but terms such as "good," "created," "caused," and "reminded" emerge more strongly. This reflects a deeper engagement with the content, as participants began to consider human involvement in disasters, the creation of disaster scenarios, and the importance of being reminded of potential risks. The shift from focusing solely on natural events to understanding the broader context of disaster creation, prevention, and the role of human action suggests that the KIT activities significantly influenced how participants think about disasters.



Figure 26. Post-test interviews word cloud

6.2.1. COMPARING PRE- AND POST-TEST INTERVIEWS

In this section, a comparative analysis between the pre- and post-test interviews will be conducted to assess the impact of the probe kits on participants' understanding of disaster-related concepts. The following subsections will explore the evolution of themes that emerged during these interviews, focusing on how participants' perspectives shifted after interacting with the probe kit. The analysis begins with a comparison of the frequency of key themes in the pre- and post-test interviews, highlighting which concepts gained prominence. This is followed by an exploration of the causal effects of the themes, examining how the probe activities influenced participants' perceptions of disaster preparedness, vulnerability, and resilience. A heatmap will then be used to visually depict the associations among themes, showcasing the interconnectivity that emerged from engagement with the probes. Finally, a radar chart will map out the relationships between themes, offering insights into the depth and complexity of participants' evolving understanding of disaster risk reduction.

6.2.1.1. THEME FREQUENCY COMPARISON

The comparison of theme frequency between pre- and post-test interviews examines how participants' understandings of key disaster-related themes changed after interacting with the probe kit. This analysis helps highlight shifts in focus and knowledge as participants engaged in various activities designed to increase their awareness and involvement in disaster preparedness. By comparing how often specific themes came up in interviews before and after the probe kit intervention, the analysis shows how much the participants' thinking evolved, particularly in areas like disaster risks, resilience, and the importance of being prepared.

One of the key themes that stood out in this comparison is Awareness and Education, which saw a clear increase in the post-test interviews. Before using

the probe kit, participants tended to have a more limited understanding of disasters, often relying on what they learned from school or general knowledge. However, after the intervention, their responses reflected a deeper and more detailed understanding of disaster-related concepts. The probe kit seemed to push them toward viewing education not just as a way to learn about risks, but as a crucial tool for disaster preparedness. Participants began to recognise that having knowledge about disaster risks and mitigation strategies is an important step in being able to handle real-life situations. This shift shows that the probe kit helped bridge the gap between knowing about disasters and understanding how to apply that knowledge in practical ways.

The theme of Community and Household Involvement and Relationships also gained more attention in the post-test interviews. Initially, many participants focused mainly on individual preparedness, such as having a personal emergency kit or knowing safety protocols. There was less emphasis on the role of family or community in disaster preparedness. However, after using the probe kit, participants began to recognise the importance of family and community networks in responding to disasters. The post-test interviews reflected a growing understanding of the role collective action plays in building resilience. Participants increasingly talked about how families and communities could work together to be better prepared, showing a shift from an individual focus to one that included a broader sense of shared responsibility. This shift is significant because it suggests the probe kit helped participants see disaster preparedness as something that requires collaboration and strong community ties, not just individual actions.

Another important theme that showed growth was Future Scenarios and Solutions. Participants were engaged with this theme both before and after the probe kit, but post-test responses showed a deeper, more forward-thinking approach. Initially, participants tended to view future disasters with a sense of inevitability or fear. After interacting with the probe kit, however, they began to

think more about long-term solutions and how disaster risks could be managed in the future. This shift reflects a change in mindset, one that emphasises planning and prevention rather than just reacting to disaster events. The probe kit seemed to encourage participants to think more critically about the steps that could be taken now to reduce future risks, suggesting a more empowered and proactive approach to disaster management.

The theme of Knowledge and Resilience also saw notable growth in the post-test interviews. At first, participants seemed to have a more general or abstract idea of resilience, often describing it as simply the ability to recover from a disaster. However, after engaging with the probe kit, their understanding of resilience became much clearer. They began to link resilience with increased knowledge and preparedness, recognising that being resilient isn't just about bouncing back but about being proactive in reducing risks. This theme's growth in the post-test interviews shows that the probe kit helped participants realise that resilience is something they can actively build by learning more about disaster risks and taking steps to protect themselves and their communities.

Lastly, the theme of Vulnerability-Focused Disaster Response and Support saw a significant increase in post-test interviews. Before the probe kit, many participants only touched on vulnerability in general terms, often mentioning children or the elderly. After using the probe kit, they began to think more critically about what makes certain populations vulnerable during disasters and how these vulnerabilities can be addressed. Participants discussed a broader range of factors, such as socioeconomic status, disability, and access to resources, which play a role in how people experience disasters. This shift shows that the probe kit helped participants develop a more in-depth understanding of vulnerability, encouraging them to think about how disaster response efforts can be tailored to better support those most in need. The changes in theme frequency are illustrated in the bar chart in Figure 27., which shows how each theme became more prominent in the post-test interviews. The

visual representation helps confirm the overall findings of the analysis, demonstrating the significant shifts in participants' focus and understanding after engaging with the probe kit. This chart highlights the growth in awareness, education, and community involvement, showing how the probe kit played a crucial role in expanding participants' perspectives on disaster preparedness and resilience.

Overall, comparing the frequency of themes between pre- and post-test interviews reveals a clear development in participants' understanding of disaster-related topics. The probe kit had a noticeable impact, encouraging participants to think more deeply about disaster preparedness, the importance of community involvement, and the need to consider vulnerability in disaster response. Through this section, it becomes evident that the probe kit not only enhanced participants' knowledge but also helped them build a more holistic and proactive approach to disaster risk reduction.

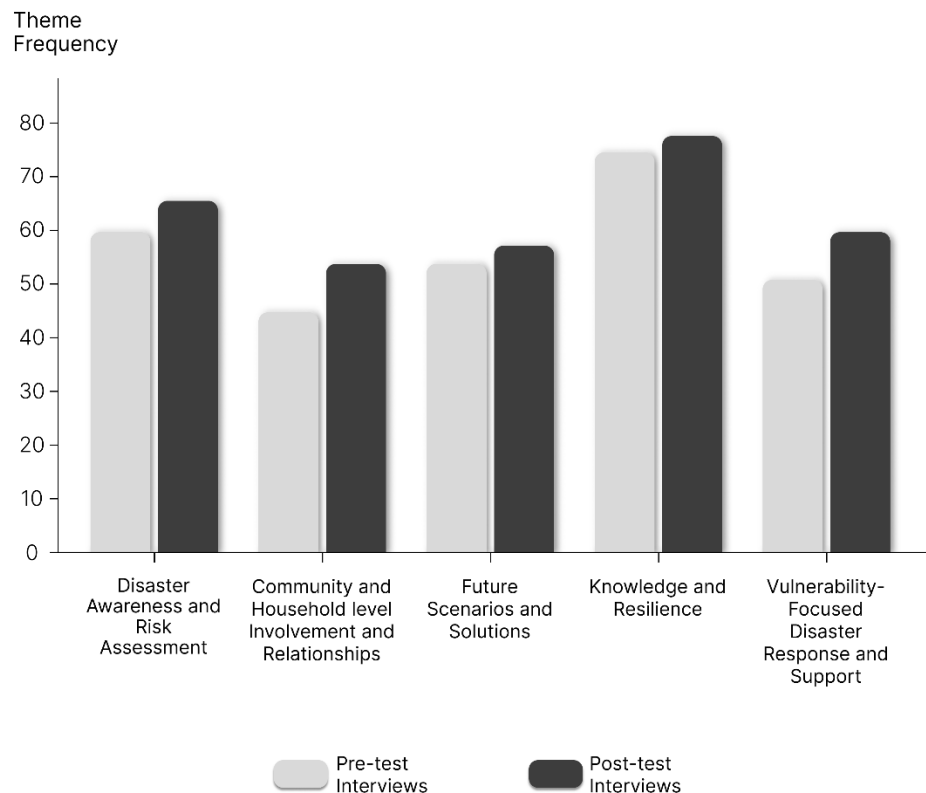


Figure 27. Theme Frequency Comparison Chart

6.2.1.2. CASUAL EFFECT OF THEMES

This section explores the changes in participants' understanding and engagement with key disaster-related themes after interacting with the probe kit. The causal effects were assessed by comparing the differences in participant responses between the pre- and post-test interviews. The line chart in Figure 20 illustrates the degree of change across five main themes: Awareness and Education, Community and Household Level Involvement and Relationships, Future Scenarios and Solutions, Knowledge and Resilience, and Vulnerability-focused Disaster Response and Support. This chart was created by measuring the shift in how frequently and deeply each theme was discussed before and after the probe kit activities. The vertical axis represents the causal effect (calculated as the net difference between pre- and post-test interviews), while the horizontal axis lists each theme. The shaded area beneath the line gives a visual representation of the magnitude of change, with peaks and dips showing where the probe kit had the greatest impact on participants' thinking.

One of the most significant changes can be seen in Community and Household Level Involvement and Relationships, where the line chart shows a sharp rise. This indicates that the probe kit strongly increased participants' awareness of the critical role families and communities play in disaster preparedness and response. Before the intervention, participants seemed to focus less on these aspects, but after engaging with the probe kit, they recognised the value of collaboration and collective efforts in reducing disaster risks. The steep upward trajectory here points to a transformative shift in how participants began to view household and community relationships as essential to resilience.

Future Scenarios and Solutions also shows a marked rise, reflecting how the participants became more future-focused after the intervention. The probe kit encouraged them to think ahead and engage with potential disaster scenarios, fostering a mindset geared towards planning and long-term preparedness. The

increase in this theme's prominence suggests that the activities helped participants to not only identify immediate disaster risks but also consider proactive measures and future solutions. This shift indicates a deeper understanding of how future-oriented thinking can help mitigate disaster risks and create more resilient communities.

While Awareness and Education, and Knowledge and Resilience show positive shifts, the changes here are less dramatic. These themes were already present to some degree in the pre-test interviews, but the post-test data reflects a clearer understanding of how education and knowledge can empower individuals and communities to reduce disaster risks. The increase in these themes suggests that the probe kit reinforced participants' appreciation for learning and resilience-building, though these concepts were not as transformative as community involvement or future planning.

Vulnerability-focused Disaster Response and Support, while showing a smaller positive shift, still highlights an important development in participants' awareness. After the intervention, there was a growing sensitivity to the needs of vulnerable populations during disaster events. Although the change here is more subtle, it indicates that participants began to think more critically about how to protect and support vulnerable groups in times of crisis. The probe kit encouraged participants to reflect on the importance of considering those most at risk, which aligns with broader disaster risk reduction goals focused on inclusivity and support for vulnerable populations.

The line chart in Figure 28 reveals the clear impact of the probe kit, showing how participants' perceptions evolved across each theme. The sharp increases in community involvement and future planning demonstrate the areas where the intervention had the greatest influence, while the more modest but still positive changes in awareness, knowledge, and vulnerability highlight areas of growth. This analysis provides a detailed view of how the probe kit shifted participants'

thinking, ultimately fostering a deeper, more comprehensive understanding of disaster preparedness and risk reduction.

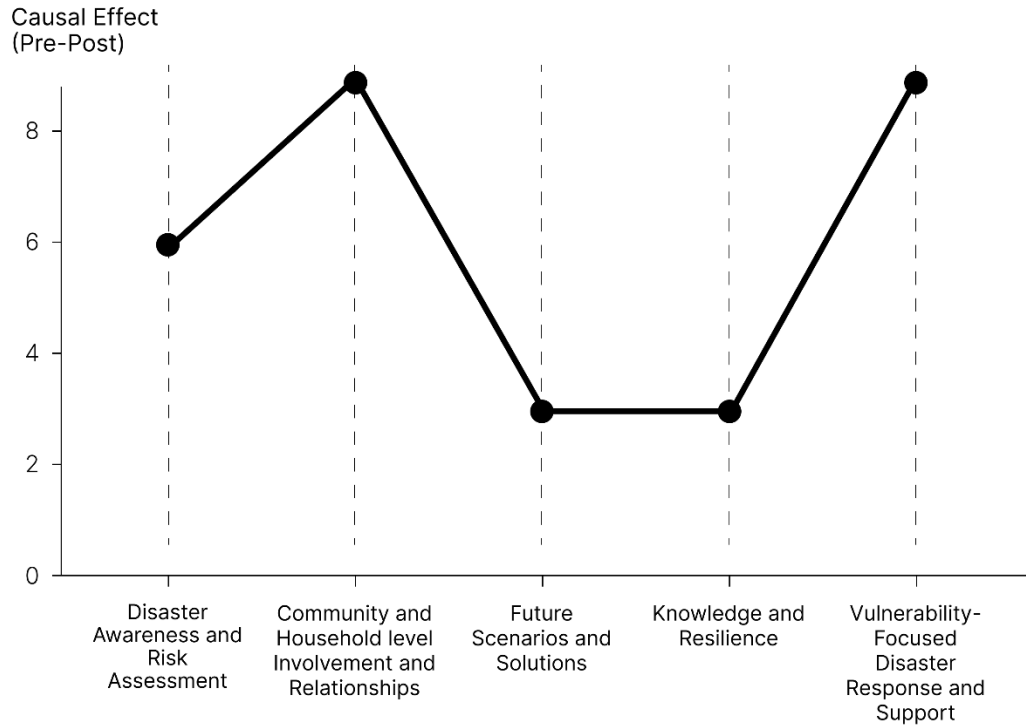


Figure 28. Causal Effect of Themes

6.2.1.3. THEMES HEATMAP AND CORRELATIONS

This section presents an analysis of the associations between the five key themes, Awareness and Education, Community and Household Level Involvement and Relationships, Future Scenarios and Solutions, Knowledge and Resilience, and Vulnerability-focused Disaster Response and Support, as reflected in both pre- and post-test interviews which is presented through the creation of a heatmap. The heatmap, Figure 21, visualises these associations, revealing how closely the themes are connected and how those connections shifted after participants engaged with the probe kit.

The heatmap allows for a clearer view of the relationships between these themes, showing which areas of disaster preparedness and risk reduction were

most closely linked from the perspective of participants. One of the most notable findings is the strong association between Community and Household Level Involvement and Knowledge and Resilience. This association remained consistent in answers to both the pre- and post-test interviews, suggesting that participants viewed their communities and households as central to building resilience. The correlation shows how discussions about the role of family and community in disaster preparedness were closely tied to themes of resilience, reflecting the understanding that a strong household and community network is foundational for recovering from and withstanding disaster risks.

Another strong connection seen in the heatmap is between Future Scenarios and Solutions and Vulnerability-focused Disaster Response and Support. This suggests that as participants thought about future disasters and the solutions needed to address them, they also increasingly considered the specific needs of vulnerable populations. After engaging with the probe kit, this association grew stronger, indicating that participants not only became more focused on planning for future scenarios but also more mindful of how those plans must include support for vulnerable groups. This heightened interplay points to the effectiveness of the probe kit in broadening participants' perspectives to consider both forward-thinking strategies and inclusive, vulnerability-sensitive approaches to disaster preparedness.

In contrast, the heatmap, as shown in Figure 29, reveals a weaker association between Awareness and Education and Vulnerability-focused Disaster Response and Support. This suggests that while participants recognised the importance of both education and supporting vulnerable populations, they tended to think of these as separate areas. Before and after the intervention, the association between these two themes remained less pronounced, which could indicate that participants viewed disaster education more in terms of individual knowledge acquisition rather than as a tool for directly addressing the needs of vulnerable groups. This insight opens possibilities for further emphasis in

educational tools like the probe kit on how raising awareness can directly contribute to better support for vulnerable populations during disasters.

The heatmap demonstrates that while the five themes are interconnected, the strength of these associations varies, with some relationships becoming more pronounced after the probe kit intervention. The growing connections between themes such as Community Involvement and Resilience, as well as Future Planning and Vulnerability Response, suggest that participants began to see disaster preparedness in more holistic terms, linking the concepts of collaboration, long-term planning, and support for vulnerable populations as essential to building resilience. However, the distinct treatment of Awareness and Education from other themes suggests that participants may still separate the acquisition of knowledge from its practical application in supporting vulnerable groups, which is an area that could be further explored and strengthened in future interventions.

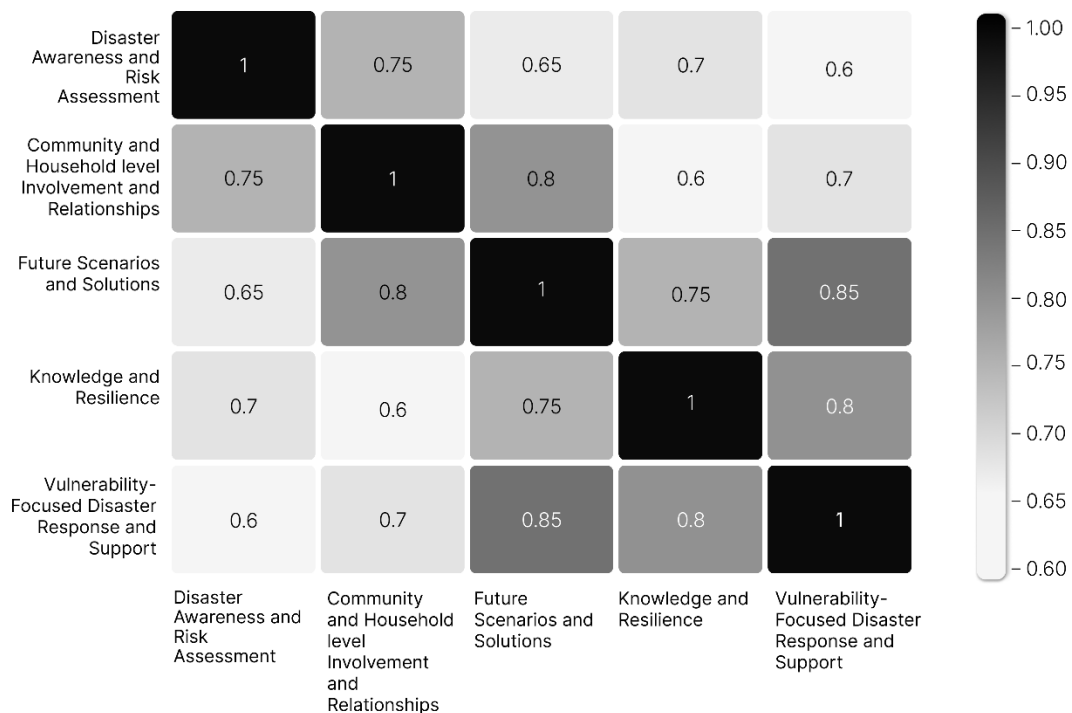


Figure 29. Heatmap of Theme Associations

6.2.1.4. THEMES RADAR CHART

The radar chart presented in Figure 26. in this section offers a visual comparison of the relationships between key disaster-related themes, mapping how these themes shifted between pre- and post-test interviews. This type of chart, also known as a spider chart, is effective for illustrating multidimensional data, enabling a clear comparison of thematic emphasis before and after participants engaged with the probe kit.

Community and Household Level Involvement and Relationships and Knowledge and Resilience show the most notable expansions in the post-test interviews. This indicates that after engaging with the probe kit, participants placed significantly more emphasis on the role of community and household dynamics in disaster preparedness. The growth in this area suggests that the intervention successfully fostered a deeper understanding of how collective efforts, whether through family networks or community support, play a critical role in building disaster resilience. The noticeable rise in Knowledge and Resilience further highlights the participants' increased appreciation of how knowledge, preparedness, and learning are interconnected with long-term resilience strategies.

Future Scenarios and Solutions also stands out with a considerable increase, pointing towards a greater awareness of forward-looking disaster management strategies among participants. This theme likely reflects participants' growing recognition that proactive planning and future-oriented thinking are essential for effective disaster preparedness. The post-test results show that participants became more adept at thinking beyond immediate disaster risks, incorporating future scenarios and solutions into their broader understanding of disaster risk reduction.

On the other hand, Awareness and Education and Vulnerability-focused Disaster Response and Support exhibit more modest growth. This suggests that while

participants' understanding of these areas did improve, the changes were not as pronounced as those seen in other themes. The moderate increase in Awareness and Education indicates that participants gained additional knowledge, though this may have been less transformational than their understanding of community involvement and resilience-building. Similarly, the growth in Vulnerability-focused Disaster Response points to a gradual shift in the participants' sensitivity to the needs of vulnerable populations, highlighting the importance of continued education and focus in this area.

The radar chart illustrates, illustrated in Figure 30, how the intervention led to a balanced increase across all themes, but with Community and Household Involvement and Future Scenarios seeing the most significant expansions. This visual representation underscores the effectiveness of the probe kit in broadening participants' perspectives and deepening their understanding of disaster preparedness, particularly in relation to collective community efforts and future disaster risk management strategies. By mapping the pre- and post-intervention relationships across these key themes, the radar chart provides a comprehensive overview of the participants' evolving views, revealing the areas where the probe kit had the greatest impact.

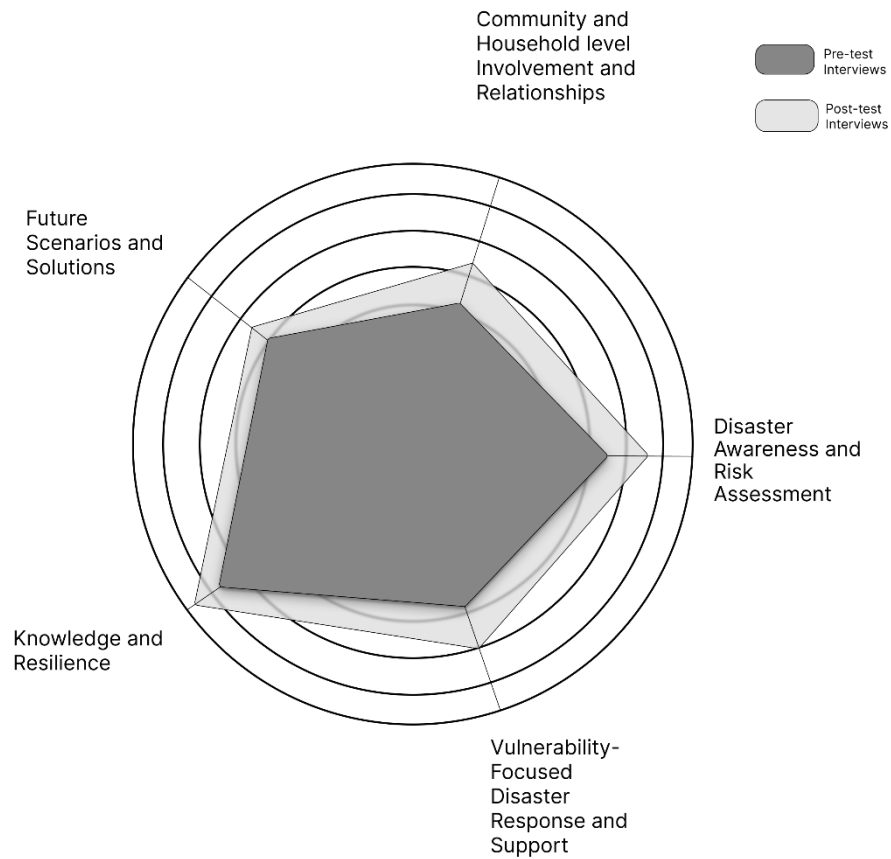


Figure 30. Radar Chart of Themes

6.2.1.5. SUMMARY OF FINDINGS AS DEMONSTRATED IN THE CHARTS

The charts collectively demonstrate the significant impact of the probe kit on participants' understanding of disaster-related concepts, as observed through the comparative analysis of pre- and post-test interviews. This section highlights how key themes such as Awareness and Education, Community and Household Involvement and Relationships, Future Scenarios and Solutions, Knowledge and Resilience, and Vulnerability-focused Disaster Response and Support evolved following participants' engagement with the probe kit. By examining changes in frequency, causal effects, and associations between these themes, the analysis

illustrates how the probe kit influenced participants' perspectives on disaster preparedness, vulnerability, and resilience.

The Theme Frequency Comparison reveals a notable increase in focus on community involvement, future disaster planning, and resilience, reflecting a shift toward collaborative and forward-thinking disaster management. The Causal Effect Analysis further emphasises these findings, showing that the probe kit had the most significant impact on participants' understanding of Community and Household Involvement and Future Scenarios, where they gained greater awareness of long-term strategies and the importance of social networks in disaster preparedness. The Heatmap of Theme Associations underscores how these themes became more interconnected after the intervention, particularly between Knowledge and Resilience and Community Involvement, as well as between Future Scenarios and Vulnerability Response. Finally, the Radar Chart provides a visual summary of how the probe kit led to balanced growth across all themes, with the most substantial expansions in community-centred and future-focused disaster strategies.

6.2.2. SENTIMENT ANALYSIS

Sentiment analysis is an essential tool for understanding not only what people are saying but also how they feel about the topics they discuss. As a natural language processing (NLP) technique, sentiment analysis helps determine the emotional tone or attitude expressed in the text. This process evaluates whether the overall sentiment is positive, negative, or neutral, allowing researchers to gain insights into the emotional responses embedded in qualitative data (Cambria et al., 2017). For this study, sentiment analysis is particularly important as it provides a deeper understanding of the emotional and cognitive shifts participants experienced throughout their interaction with the probe kit. By assessing the emotional undertones of the pre- and post-test interviews, this analysis adds an extra layer to the findings, illustrating not only what participants

learned but also how their attitudes and feelings evolved regarding disaster preparedness and resilience.

In recent years, sentiment analysis has been applied in disaster contexts to assess public emotions and reactions during crises, such as during earthquakes, floods, or hurricanes (Ragini et al., 2018; Sakaki et al., 2012). These studies show that understanding the emotional state of individuals in such events can help improve disaster risk communication and recovery strategies. In the context of this study, sentiment analysis not only measures the participants' knowledge acquisition but also how their emotions evolved as they became more familiar with disaster preparedness through the probe kit.

For this study, the sentiment analysis was conducted using NVivo and Qualtrics (Clara bridge), which enabled the processing of qualitative data at scale. These tools allowed for the systematic examination of participants' responses before and after interacting with the probe kit, focusing on the emotional depth and tone of their reflections on disaster preparedness and related concepts.

The sentiment analysis revolves around two key metrics: polarity and subjectivity, both of which offer critical insights into how participants emotionally processed the topics discussed. Polarity measures the degree to which a sentiment is positive or negative, giving a direct indication of whether participants expressed optimism, concern, or neutrality. Polarity is measured on a scale from -1 to +1, where -1 represents a highly negative sentiment, +1 reflects a strongly positive sentiment, and 0 indicates neutrality (Liu, 2020). For example, when participants spoke about their newfound understanding of disaster resilience in the post-test interviews, a higher polarity score could signify more positive emotions, such as confidence or hope. In contrast, negative polarity scores might highlight fears or concerns about disaster risks, especially in pre-test responses where participants might have felt unprepared.

The second metric, subjectivity, focuses on the degree to which a text is opinion-based or fact-based. This measurement ranges from 0 to 1, with 0 representing objective, fact-driven statements, and 1 indicating highly subjective, emotion-laden responses (Pang & Lee, 2008). Subjectivity provides insight into how personal or emotionally driven participants' responses were, offering a window into their level of personal engagement with the topics. For example, a higher subjectivity score in the post-test interviews might suggest that participants were not only more informed but also more emotionally invested in disaster preparedness, reflecting on how it impacts their lives or their communities.

Polarity and subjectivity together create a fuller picture of the emotional landscape of the interviews. Polarity tells us the direction of the emotional tone, whether positive, negative, or neutral, while subjectivity helps gauge how much of that tone is driven by personal opinion versus objective reflection. In this study, these two metrics are invaluable for understanding the emotional and cognitive changes participants underwent. As participants became more knowledgeable through the probe kit activities, the sentiment analysis helped illustrate whether they felt more confident, hopeful, or still anxious about disaster preparedness and risk.

Recent studies highlight the importance of incorporating sentiment analysis in DRR research to understand public sentiment and improve engagement in preparedness activities (Imran et al., 2015; Liu, 2020). Using sentiment analysis in this study makes it possible to assess how much knowledge participants gained and how their emotional responses shifted throughout the process. The sentiment analysis in this study complements the thematic findings by adding emotional depth to the understanding of how participants engaged with disaster-related themes. Not only does it reveal shifts in knowledge and perspective, but it also uncovers how those shifts were accompanied by emotional responses, providing a richer, more human-centred view of the impact of the probe kit

intervention. Table 5 demonstrates the changes in sentiment across the themes. It also highlights how participants' emotional engagement with the themes have shifted after their interactions with the probe kits.

Table 5. Confidence and Emotion Analysis

Theme	Pre-test Polarity	Pre-Subjectivity	Pre Sentiment	Post Polarity	Post Subjectivity	Post Sentiment	Interpretation
Awareness and Education	0.1	0.4	Positive	0.3	0.5	Positive	Increased positivity and personal engagement in disaster education post-intervention.
Community and Household Involvement	0.0	0.3	Neutral	0.4	0.6	Positive	Participants became more emotionally invested in family and community roles in disaster preparedness.
Future Scenarios and Solutions	0.0	0.0	Neutral	0.2	0.6	Positive	Post-activity optimism and increased engagement with future disaster scenarios and proactive solutions.
Knowledge and Resilience	0.2	0.5	Positive	0.4	0.6	Positive	Participants felt more resilient and confident in their ability to manage crises after using the KIT tool.
Vulnerability-focused disaster response	0.0	0.4	Neutral	0.3	0.6	Positive	Greater empathy and understanding of the need for tailored support for vulnerable groups post-intervention.

An expanded interpretation is that the probe kit as a tool had a transformative effect on participants' understanding across several key themes, shifting their perspectives from neutral or disconnected views to more engaged and positive ones. In the area of Awareness and Education, participants moved from a vague understanding of disaster education to a more empowered and positive outlook. They expressed feeling more capable of applying the knowledge they gained after interacting with the probe kit. Similarly, the theme of Community and Household Involvement showed a clear transformation. Initially, participants held neutral views on family and community collaboration in disaster preparedness. However, post-interview responses revealed a strong belief in the importance of collective efforts, indicating that the probe kit effectively fostered personal engagement with community-level preparedness.

For Future Scenarios and Solutions, participants initially felt disconnected from thinking about future disaster scenarios and their solutions. After using the probe kit, their perspectives shifted toward greater optimism and personal involvement, with increased subjectivity in their responses reflecting a newfound sense of empowerment in planning for future disasters. Knowledge and Resilience saw participants transition from a basic understanding of resilience to a more confident and actionable belief in their ability to manage crises. Post-interview responses demonstrated stronger positivity and a deeper personal connection to resilience, highlighting the probe kit's role in enhancing in taking practical steps towards disaster preparedness. In Vulnerability-focused Disaster Response, the probe kit encouraged participants to develop greater empathy and concern for vulnerable groups. Their neutral stance transformed into one of personal responsibility as they gained a clearer understanding of the need to support those most affected by disasters. This shift illustrates how the probe helped foster a more proactive approach to disaster response.

Building on the insights from the previous sentiment analysis, the next part delves into Confidence and Emotion Analysis, which further explores the impact

of the probe kit on participants' self-assurance and emotional engagement with disaster preparedness themes. This is particularly relevant and important as one of the main focuses of this study has always been the empowerment of children and the attempt towards encouraging agency and conveying that children can in fact be active agents of change in disaster scenarios. This section highlights the deeper personal connections they developed with key themes by assessing how participants' confidence and emotional responses evolved from the pre-test to the post-test interviews. As shown in Table 6, the probe kit not only enhanced participants' understanding but also significantly boosted their confidence levels and emotional engagement across all themes. Initially, participants expressed varying degrees of uncertainty and emotional detachment, particularly in areas like community involvement and future planning. However, after engaging with the activities, there was a marked increase in both confidence and emotional involvement, with participants demonstrating a stronger belief in their ability to apply the knowledge gained and an increased empathy towards supporting vulnerable populations. This analysis underscores how the probe kit empowered participants to feel more connected to disaster preparedness, fostering a sense of personal responsibility and active engagement in disaster risk reduction.

Table 6. Confidence and Emotion Analysis

Theme	Pre Confidence	Post Confidence	Pre Emotion	Post Emotion	Interpretation
Awareness and Education	Moderate (1)	High (2)	Moderate (1)	High (2)	Pre: Participants displayed moderate confidence in their knowledge of disaster education. They were somewhat aware of the importance of education in preparedness, but there was still a level of uncertainty about how much they knew and how well they could apply this knowledge. Post: After engaging with the KIT tool, participants showed a significant increase in both confidence and emotional engagement. They felt more empowered, with a deeper personal connection to disaster preparedness, enabling them to confidently educate themselves and others.
Community and Household Involvement	Low (0)	High (2)	Low (0)	High (2)	Pre: Initially, participants had low confidence and emotional involvement regarding the role of communities and families in disaster preparedness. They viewed this aspect of preparedness as somewhat irrelevant to their own experiences or responsibilities. Post: After using the KIT tool, participants demonstrated high levels of confidence and emotional investment in the importance of collective action. The tool helped them recognise the vital role of community involvement in disaster resilience, and they became strong advocates for family and community collaboration in preparedness efforts.
Future Scenarios and Solutions	Low (0)	Moderate (1)	Low (0)	Moderate (1)	Pre: Participants were initially disengaged and unsure of their ability to think ahead and plan for future disaster scenarios. They lacked confidence in their role in anticipating and addressing future crises. Post: The KIT tool brought about a moderate increase in both confidence and emotional involvement, helping participants envision tangible solutions for future disaster scenarios. They now felt more optimistic and capable of contributing to planning and preparedness for upcoming risks.
Knowledge and Resilience	Moderate (1)	High (2)	Moderate (1)	High (2)	Pre: Participants had some confidence in their knowledge of resilience, but this understanding was not very deep. They recognised the importance of resilience but did not feel fully equipped to handle disasters with certainty. Post: The KIT tool significantly boosted participants' confidence in their resilience. It provided practical steps and strategies that transformed their general understanding into a more empowered belief that they could effectively cope with disasters and maintain resilience.
Vulnerability-focused Disaster Response	Low (0)	High (2)	Low (0)	High (2)	Pre: Participants showed little emotional or confident engagement with the idea of supporting vulnerable groups during disasters. They were aware of the concept but did not feel particularly connected to it or responsible for addressing it. Post: After using the KIT tool, participants developed a much stronger sense of empathy and confidence in the need to prioritise vulnerable populations during disaster responses. They gained a deeper understanding of how important it is to offer tailored support to those who are most at risk.

The probe kit had a powerful effect on participants' confidence and emotional connection to key disaster preparedness themes. In Awareness and Education, participants initially felt somewhat confident but still uncertain about their knowledge. By the end, they emerged feeling empowered and much more confident in their ability to educate themselves and others. The kit helped turn disaster education from just an awareness issue into something they felt ready and able to act on, creating a stronger personal connection to the topic.

The most significant change was seen in Community and Household Involvement. Before the intervention, participants showed little interest or confidence in the idea of family and community collaboration for disaster preparedness. However, after using the kit, their views transformed completely. They came to believe in the importance of working together as a community and felt confident in promoting this idea. In Future Scenarios and Solutions, participants initially felt disconnected and unsure of their ability to prepare for future disasters. The kit helped them shift to a more optimistic mindset, build their confidence, and picture real solutions for future risks. Similarly, in Knowledge and Resilience, participants moved from a general understanding of resilience to a more actionable, confident belief in their ability to be resilient during a disaster.

Lastly, the Vulnerability-focused Disaster Response theme showed a noticeable shift. At first, participants didn't feel particularly connected to the idea of helping vulnerable populations during disasters. However, after using the kit, they gained a stronger sense of empathy and responsibility, along with the confidence to support vulnerable groups as an important part of disaster planning.

6.3. KEY INSIGHTS: TRANSLATING PROBES INTO PREPAREDNESS

The findings from the comparative analysis reveal a compelling narrative of transformation in the participants' understanding and application of Disaster Risk Reduction (DRR) concepts. By engaging with the probe kit, participants not only deepened their awareness of disaster risks but also demonstrated a marked shift from passive knowledge to active preparedness. This evolution showcases the potential of the probe activities to inspire meaningful action, fostering a sense of responsibility and agency among the participants.

One of the key takeaways from the analysis is the transition from abstract knowledge to tangible preparedness strategies. Initially, participants' understanding of disasters was often limited to natural phenomena and broad-stroke concepts learned through formal education or personal experiences. Post-intervention, this understanding expanded to include human influence on disasters, the importance of collective preparedness, and the proactive steps required to mitigate risks. For instance, participants moved from perceiving disasters as inevitable events to recognising their ability to take preventive actions, such as creating family emergency plans or envisioning innovative future solutions. These actions reflect a heightened sense of agency, where participants no longer view themselves as passive observers but as active contributors to disaster preparedness.

Moreover, the comparative analysis highlights how the probe activities fostered critical thinking and reflection. Participants not only identified potential risks in their surroundings but also developed practical, often creative, strategies for addressing them. Activities like the Time Capsule and Disaster Board Game encouraged them to think beyond immediate risks and engage in forward-looking solutions, linking present actions to long-term resilience. This connection between knowledge and action is particularly evident in their reflections on community involvement and vulnerability-focused responses. By exploring the roles of families, neighbours, and vulnerable groups in disaster

scenarios, participants demonstrated a growing awareness of the importance of collaboration and inclusivity in preparedness efforts.

Another critical insight is the shift in participants' emotional and cognitive engagement with DRR. As revealed through sentiment analysis, participants expressed increased confidence and positivity in their ability to manage disaster risks. This emotional transformation, coupled with their deeper understanding of DRR concepts, translated into a willingness to take concrete actions, such as advocating for community-based preparedness or developing resourceful strategies to support vulnerable populations. The integration of empathy and critical reflection into their learning journey illustrates how the probes succeeded in translating heightened understanding into meaningful, actionable preparedness.

In sum, the comparative analysis shows that the probe kit not only enhanced participants' knowledge but also equipped them with the tools and mindset necessary to translate that knowledge into preparedness. By fostering a balance of critical thinking, emotional engagement, and practical action, the probe activities demonstrate their capacity to inspire a generation of learners better equipped to tackle disaster risks proactively and collaboratively. These findings highlight the immense potential of thoughtfully designed educational tools to bridge the gap between learning and action, paving the way for a more resilient and prepared future. At the same time, the move from awareness to action is not linear or uniform. The analysis echoes that it is, in fact, shaped by contextual factors such as facilitation, household dynamics, and the opportunities participants have to apply preparedness practices beyond the probe activities. In theoretical terms, the chapter supports a child-centred account of DRR learning in which probes operate as a mechanism for linking knowledge, emotion, and agency, while also clarifying the boundaries within which "empowerment" can be meaningfully claimed.

6.4. CHAPTER SUMMARY

This chapter demonstrates the significant impact of the probe kit in transforming participants' understanding of DRR from abstract knowledge to actionable preparedness, showing how the activities supported shifts in awareness, confidence, and agency across key thematic areas. The comparative analysis of pre- and post-test interviews highlights significant growth in key themes, including awareness and education, community and household involvement, and future scenarios and solutions. Participants moved from a limited understanding of disasters as inevitable natural events to recognising their own agency in disaster preparedness, encompassing both individual and collective responsibilities. Visual tools such as word clouds, heatmaps, and radar charts further illustrate these shifts, showing enhanced interconnections between critical themes and a deeper understanding of resilience and vulnerability, thereby evidencing the strength of the probe kit in supporting more connected and reflective thinking about DRR.

Sentiment analysis adds an emotional dimension to these findings, revealing increased confidence and positivity among participants regarding their ability to manage disaster risks. This heightened emotional engagement within the study's cohort translated into tangible actions, such as developing family emergency plans and advocating for community collaboration in disaster preparedness. The chapter also emphasises the role of empathy and inclusivity, with participants demonstrating greater awareness of the needs of vulnerable populations and exploring practical solutions to support them. Overall, the chapter highlights how the probe kit bridged the gap between learning and action, equipping participants with the tools, mindset, and confidence necessary for proactive DRR. These findings emphasise the potential of educational interventions to inspire meaningful preparedness and foster a future generation that is both resilient and empowered to collaboratively address disaster risks.

*"Design is the intermediary between
information and understanding..."*

– Richard Grefé



CHAPTER 7 – DISCUSSION

7.1. CHAPTER INTRODUCTION

This chapter reflects on how the study's findings address the core research questions and objectives. The research was driven by the aim to explore innovative ways of engaging children in DRR through the use of design probes. These tools were specifically designed to go beyond traditional and top-down disaster education methods, like school drills, by providing children with interactive, playful, and hands-on activities that would allow them to explore and discover.

Traditional DRR education, while important for teaching procedural responses, often fails to engage children emotionally or foster a deeper understanding of the underlying principles of disaster preparedness (Johnson et al., 2014). School-based drills, for example, focus heavily on procedural knowledge, how to respond in the event of a disaster, but rarely offer opportunities for children to explore the "why" behind these actions or to think critically about broader issues like risk perception, household and communal relationships, human agency in disaster contexts, and long-term resilience. The design probes introduced in this study addressed this gap by offering children a more personal and immersive experience. Through narrative-driven activities, creativity, and exploration, children were encouraged to critically assess disaster scenarios, identify potential risks within their environments, and come up with solutions. This approach aimed to foster both intellectual engagement and emotional investment in DRR, helping children move from passive recipients of information to active participants in building disaster resilience.

The findings from the study indicate that design probes not only helped children understand disaster preparedness on an individual level but also empowered them to share this knowledge with their families and communities. Peek et al. (2018) highlight the importance of children's involvement in family

preparedness, and this research corroborates their findings, showing how design probes sparked intergenerational dialogue. Through these activities, children became active participants in disaster awareness, sparking curiosity and conversations within their households. Many shared their experiences at home, prompting discussions about household emergency plans, encouraging their families to reflect on their preparedness levels, and even inspiring actions such as assembling emergency kits or preparing a family emergency plan. This confirms that creative, child-centred approaches have the potential to bridge generational gaps in disaster education, positioning children as agents of change who inspire broader household and community engagement in DRR.

By revisiting each of the research questions and objectives in the following sections, the study brings focus to the potential of design probes to be transformative in DRR efforts. These tools were shown to enhance children's awareness, participation, and motivation and an increased interest in disaster preparedness. The findings contribute not only to the academic understanding of child-centred disaster education but also provide practical insights into how such approaches can be implemented to build more resilient communities. This chapter connects the findings to the bigger picture of participatory education and disaster resilience, contributing to ongoing discussions in the field. It also delves into how each research question was tackled and how the study's goals were achieved, highlighting the wider impact of using creative, interactive approaches in DRR education.

7.2. ADDRESSING RESEARCH QUESTIONS AND OBJECTIVES

As previously outlined, the study focused on understanding how design probes can be used to promote children's active participation in DRR. The research was guided by key questions and objectives, centred on exploring how playful, interactive methods, such as design probes, can foster disaster awareness, resilience, and preparedness among children. The aim was not only to create

educational tools but also to uncover the deeper implications of using design probes to engage children meaningfully in DRR.

To provide an overview of the study, Figure 31 offers a visual summary of the overall logic of the research, showing how the inquiry progressed from the initial questions and design decisions through data collection and analysis to the main themes, findings, and contributions. It captures how different strands of the work came together and how contextual challenges were taken into account. In doing so, it illustrates the pathway from the original aims to the results and outcomes presented in this chapter, indicating that the core research goals and objectives were achieved.

The following discussion revisits each research question alongside its corresponding objectives, illustrating how the findings addressed the foundational aims. This serves as a reminder of how the research contributions aligned with the goals of understanding how design probes can be transformative in engaging children and fostering resilience within their communities. By reflecting on these key areas, the study highlights the potential of design probes as tools that enhance both individual and collective disaster preparedness.

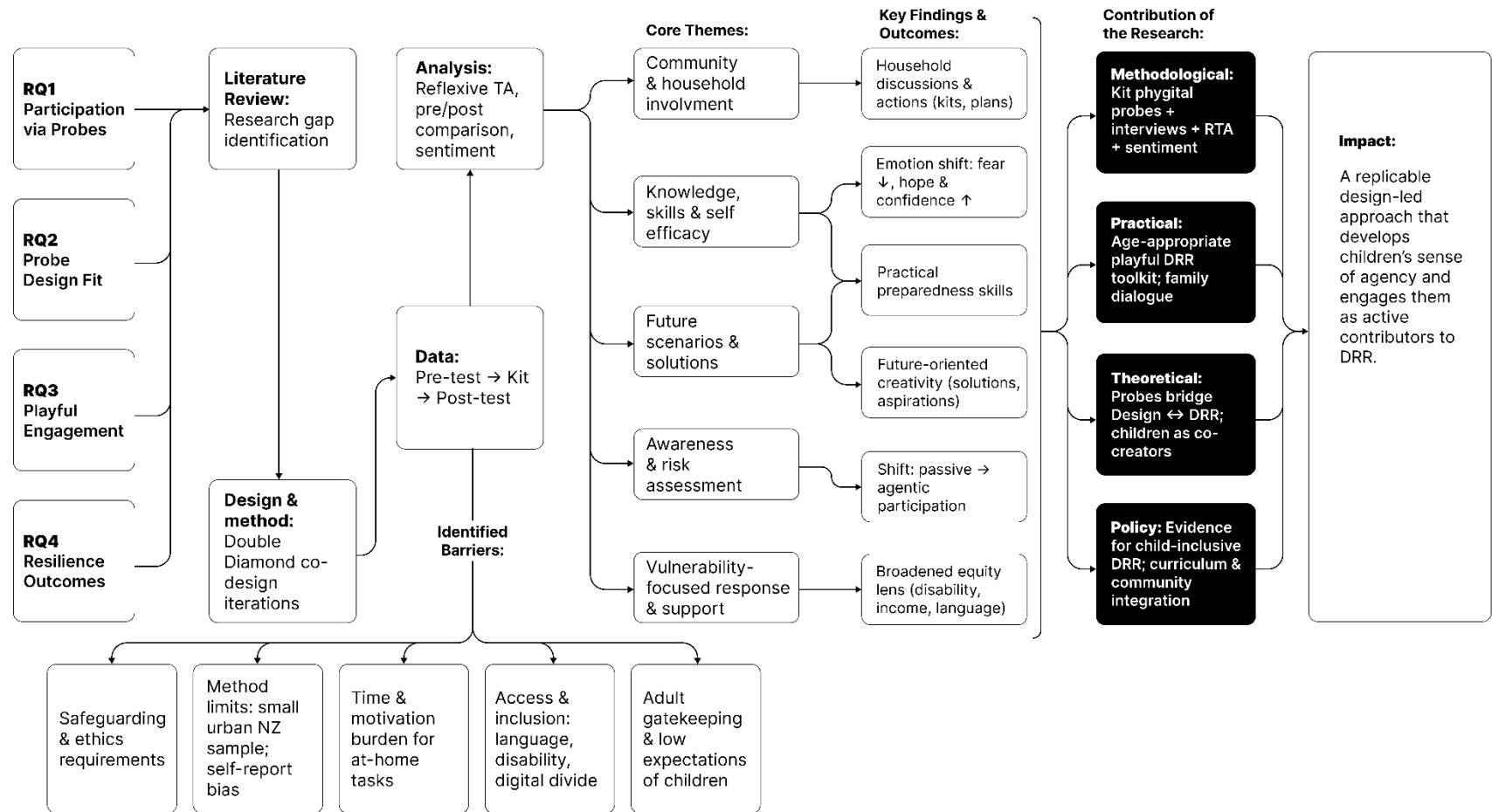


Figure 31. Figure 31. Overview of the study's research questions, process, themes, findings, barriers, and contributions.

7.2.1. RESEARCH QUESTION 1: HOW CAN DESIGN PROBES BE UTILISED TO PROMOTE CHILDREN'S ACTIVE AND CREATIVE PARTICIPATION IN DRR?

This research question aimed to explore the unique potential of design probes as tools to engage children in a manner that not only fosters creative expression but also promotes active involvement in DRR. The existing research on DRR education often focuses on traditional methods, such as classroom-based teaching or top-down disaster drills, which overlook the potential of more creative and participatory approaches. Research by Amri et al. (2018) and Hore et al. (2018) highlighted the limitations of procedural drills, showing the need for more engaging and reflective methods. This study addresses that gap by introducing design probes as an innovative, child-focused approach to disaster preparedness. Unlike earlier work, which hasn't looked at using design probes to engage children in Disaster Risk Reduction (DRR), this research makes a unique contribution by empowering children to take an active role in disaster preparedness. It explores how design probes can enhance children's resilience and participation, focusing on how these tools can be designed and what activities work best to encourage active involvement. The findings show that design probes can, in fact, help create an environment where children go beyond passively receiving information. Instead, they engage with DRR concepts through exploration, reflection, and creative problem-solving.

The findings demonstrated that design probes, with their interactive and playful components, encouraged children to freely express their ideas, concerns, and solutions in a way that was both meaningful and impactful. This reflects Freire's (2020) principles of participatory learning, where learners actively build knowledge through interaction and reflection. The use of narrative, sensory engagement, and gamified elements within the probes allowed children to grasp complex disaster-related topics in a manner that resonated with their cognitive and emotional development. Children's ability to articulate their thoughts on disaster preparedness improved significantly, as evidenced by the comparison of their responses to the pre- and post-interaction interviews, where children

shifted from simply understanding the concept of disasters to actively proposing solutions for preparedness and risk mitigation. This shift in engagement directly addresses the research gap, as it demonstrates how creative, child-led approaches, like design probes, offer an innovative and more effective way engaging children in DRR concepts compared to traditional methods.

The outcomes also supported Objective 4, which aimed to understand children's perspectives on the integration of design probes in DRR and their role as proactive agents of change. This reflects Bronfenbrenner's (1979) emphasis on the interconnectedness of individual agency and environmental systems, where children's engagement in disaster preparedness influences their immediate social networks. The study found that children who engaged with the design probes internalised the knowledge through an inspired path of exploration and discovery. Children initiated conversations with their families about preparedness and disaster risks, contributing to a broader culture of resilience that extended beyond the classroom or study environment. This finding aligns with existing literature, such as Anderson's (2005) work, which highlights the potential for children to play active roles in promoting disaster preparedness at the household level.

These findings also illustrate a clear movement up Hart's (R. Hart, 1992) Ladder of Participation, from tokenistic involvement, typical of top-down DRR education, toward genuine collaboration and child-initiated action. Through the bottom-up design of the probes, children moved beyond merely following adult-defined instructions to actively interpreting, adapting, and co-creating disaster-preparedness knowledge. Their responses reflected not only understanding but ownership, indicating engagement at the higher rungs of participation where decision-making is shared between adults and children.

7.2.2. RESEARCH QUESTION 2: HOW SHOULD A SET OF DESIGN PROBES BE CRAFTED TO SUIT THE CONTEXT OF DRR AND FOSTER MEANINGFUL PARTICIPATION AMONG CHILDREN?

The second research question focused on the methodological and creative considerations involved in designing effective design probes for DRR. Research by Towers (2016) and Gaillard & Mercer (2013) brings attention to the importance of creating educational tools that align with children's developmental and cognitive needs. Building on their work, this study addresses a key gap in the literature: the lack of guidance on designing tools that effectively engage children with complex topics such as DRR. To fill this gap, the study developed a set of design probes specifically tailored to children, offering a novel framework that balances educational and playful elements. This directly ties to Objective 2, which focused on assessing the effectiveness and engagement of the design probes, particularly through their visual appeal and overall design. The findings revealed that the success of these probes in fostering meaningful participation among children depended on several critical factors, including age-appropriate content, flexibility, and the balance between learning and creative engagement. Moving away from traditional top-down methods, the probes encouraged children to explore DRR concepts actively, leading to a deeper and more personal understanding of disaster preparedness.

The study revealed that the design of the probes was central to capturing children's attention and ensuring sustained engagement. The iterative design process in this study, rooted in user-centred design principles (Norman Donald, 2013), ensured that the probes were both visually engaging and functionally effective in conveying DRR concepts. Key visual elements, such as engaging illustrations, interactive storytelling, hands-on activities, and gamified mechanics, played an important role in capturing and maintaining children's interest in the subject matter. Other research on child-centred educational design further supports this, emphasising how multimodal engagement, through visuals, narrative, and interactivity, can foster deeper cognitive and emotional

connections to learning materials (De et al., 2020). However, the effectiveness of the probes extended beyond their visual appeal, highlighting the importance of combining aesthetics with thoughtful design to foster meaningful engagement and understanding.

The integration of flexible, child-led exploration allowed children to navigate the probes at their own pace, making the learning experience feel personalised and accessible. This flexibility also enabled children to engage with the material in ways that aligned with their individual learning styles, ensuring that each child could participate meaningfully, regardless of their prior knowledge or experience with DRR concepts. This aligns with Vygotsky's theories on scaffolding, where learners construct knowledge through guided exploration within their zone of proximal development (Kozulin, 2022). Scaffolding, in this context, refers to the way in which the probes provide structure and support while still allowing children to take an active role in their own learning. By engaging with open-ended activities, storytelling prompts, and hands-on challenges, children were encouraged to think critically and build on their existing understanding of disaster preparedness. The probes acted as a mediating tool, offering just enough guidance to spark curiosity and inquiry while allowing children to develop their own interpretations and solutions. This supports Vygotsky's assertion that learning is most effective when children are given opportunities to expand their knowledge through interactive, socially and cognitively engaging experiences.

In addition to this, Objective 3, which sought to explore how the probe kits improved children's understanding and awareness of disasters, was addressed through the comparison of pre- and post-interaction interviews. The findings showed that the design of the probes facilitated a significant increase in children's awareness of disaster risks and preparedness strategies. Children were able to recall key concepts, articulate the steps involved in disaster preparedness, and even demonstrate a deeper understanding of the social and

environmental factors that contribute to disaster risks. This outcome highlights the importance of careful design in creating educational tools that are both engaging and effective, supporting literature that emphasises the need for child-friendly disaster education tools (Towers, 2016).

Furthermore, the study aimed to keep a balance between creating an engaging, immersive experience and ensuring that the content was not overwhelming or distressing for the participants. The iterative design process allowed for the refinement of activities to ensure that this balance was achieved and that the activities were appropriate for the children's developmental stages, beginning with simpler, ice-breaker activities and gradually introducing more complex, thought-provoking tasks. This careful structuring of the activities helped foster a sense of progression and accomplishment, ultimately enhancing the children's sense of agency in relation to disaster preparedness. This structured approach contrasts with traditional drills, which often lack the flexibility needed to accommodate individual learning trajectories (Paton, 2019b).

7.2.3. RESEARCH QUESTION 3: IN WHAT WAYS DO PLAYFUL ACTIVITIES, AS PART OF THE DESIGN PROBES, ENHANCE CHILDREN'S UNDERSTANDING AND ENGAGEMENT IN DISASTER PREPAREDNESS?

The third research question focused on the role of play in enhancing children's understanding and engagement with DRR concepts. Previous studies have shown the value of play in general education and its specific application to DRR education. However, it has not been fully explored the extent to which play-based approaches can contribute to disaster education, creating a gap that this study sought to fill. By integrating playful activities into the design probes, this study demonstrated that play can be a powerful tool for enhancing children's cognitive and emotional engagement in DRR. Objective 3, which examined how the probe kits enhanced children's awareness and understanding of disasters, provided the foundation for addressing this question. The study revealed that the carefully designed activities, with the integration of game mechanics,

storytelling elements, and overall quality design, embedded within the design probes were not merely supplementary but integral to fostering deep engagement and understanding among the participants.

The inclusion of role-playing games, and collaborative tasks allowed children to explore disaster-related concepts in a manner that felt accessible and enjoyable. By making learning fun, these activities reduced the anxiety often associated with discussions about disasters, enabling children to engage with the material more openly and confidently. The playful nature of the activities also encouraged children to think creatively about disaster preparedness, coming up with imaginative solutions for potential disaster scenarios. This creative problem-solving aspect of play was particularly impactful, as it helped children move from theoretical understanding to practical application, bridging the gap between knowledge and action.

The findings also demonstrated that playful activities promoted emotional engagement, which is critical in enhancing children's retention of information and their ability to apply what they have learned. As children engaged with the playful components of the probes, they formed emotional connections with the material, which in turn deepened their understanding of the importance of disaster preparedness. This emotional engagement was evident in the post-interaction interviews, where children expressed a greater sense of responsibility and confidence in their ability to contribute to DRR efforts. The study's findings resonate with research by Amri et al. (2018), which highlights the importance of play in promoting cognitive and emotional engagement in educational contexts. Their work emphasises that play not only enhances knowledge acquisition but also fosters a sense of agency and emotional investment in learning, making information more memorable and actionable. In the context of DRR, play creates a safe space for children to explore complex and potentially distressing topics in an accessible and engaging way, helping them process risk-related information more effectively. This aligns with the

findings of this study, where children who participated in playful, exploratory activities within the design probes demonstrated a stronger emotional connection to DRR concepts and a greater willingness to apply their learning in real-world contexts.

Moreover, Objective 1, which explored how design probes contribute to children's resilience, was also a good link to this research question and was met through the implementation of these playful activities. By allowing children to engage with disaster scenarios in a low-pressure, enjoyable environment, the playful elements of the probes fostered critical thinking and problem-solving skills. Children were able to explore different disaster preparedness strategies, test out various solutions, and reflect on the outcomes in a way that felt empowering rather than overwhelming. This approach not only improved children's understanding of disaster risks but also fostered a sense of agency, as children showed this increased notion and realisation that they could take proactive steps to prepare for potential disasters and become agents of change disaster scenarios.

7.2.4. RESEARCH QUESTION 4: WHAT ARE THE OUTCOMES OF APPLYING DESIGN PROBES IN TERMS OF BUILDING RESILIENCE AND PREPAREDNESS IN CHILDREN?

The final research question aimed to evaluate the tangible outcomes of using design probes in building resilience and preparedness in children. Addressing a clear gap in existing research, this study sought to provide concrete evidence of how innovative, participatory tools like design probes could lead to measurable improvements in children's disaster preparedness. Unlike traditional methods that offer limited insight into long-term impacts on children's preparedness and resilience, this study provided a new framework for understanding how design probes can effect lasting change through designing and implementing activities that encourage deeper reflection and critical thinking on the topic of disasters today and into the future. This question was primarily linked to Objective 1, which

focused on enhancing children's resilience and participation in DRR. The findings from the study demonstrated that children who engaged with the design probes experienced significant improvements in their understanding of disaster risks, preparedness strategies, and their roles in mitigating these risks.

Post-test interviews revealed that children gained an increased ability to identify hazards in their environments, articulate preparedness measures, and express confidence in their capacity to respond to potential disasters. These outcomes are particularly significant in addressing the gap in the literature around child-centred DRR initiatives that go beyond theoretical learning to foster practical, actionable preparedness strategies. These outcomes indicated that the design probes were effective not only in enhancing individual knowledge but also in fostering behavioural changes at the household level. Many children reported initiating conversations about disaster preparedness with their families, and some even influenced their households to take concrete preparedness actions, such as creating emergency plans or discussing evacuation routes. This behavioural shift from passive recipients of information to active participants in disaster preparedness demonstrates the success of the design probes in fostering a sense of agency and responsibility among the children, one of the key goals of the study.

Moreover, the application of the design probes led to a growing awareness among children of their potential role in disaster preparedness. Rather than viewing preparedness as solely an adult responsibility, children began to recognise ways in which their actions, however small, could contribute to the safety and well-being of their families and communities, both in the present and in the future. This finding aligns with the broader literature on child-centred DRR, which focuses on empowering children with the knowledge and tools to respond to disasters that not only benefit the children themselves but also have a ripple effect on their wider social environments (Peek et al., 2018). The ability of the design probes to foster this sense of agency underscores their value as an

educational tool that goes beyond traditional DRR methods by actively involving children in meaningful ways.

The study also addressed Objective 4, which explored how children's engagement with the probes influenced their roles as proactive agents of change within their communities. The findings showed that children who participated in the design probe activities became advocates for DRR within their families and social circles, contributing to a broader culture of preparedness. By sharing the knowledge and strategies they learned through the probes, children influenced not only their households but also their peer groups, demonstrating the far-reaching impact of engaging children in DRR through creative, participatory methods.

Children's roles as change agents were most notably observed in the way they initiated conversations about preparedness with their families. In several instances, children reported that their families had not previously considered certain aspects of disaster preparedness, such as the importance of having an emergency kit or having a family emergency plan, until the children brought these issues to their attention. This chain reaction, where children's learning influences the actions of their families and even their communities, highlights the potential of design probes to create systemic change. By involving children in disaster preparedness, the study demonstrated that the knowledge and skills gained through the probes were not confined to the individual but extended into the broader community context.

Furthermore, the outcomes of this research question align with objective 4, which posits that children, through their engagement with design probes, can emerge as proactive agents of change in disaster contexts. The findings of the study support this objective by illustrating that children not only adopted the knowledge gained through the probes but also took the initiative to apply this knowledge to real-world scenarios. This proactive engagement highlights the

potential for child-centred educational tools to contribute to a culture of preparedness that extends beyond the individual and permeates family and community networks.

Finally, the application of design probes in this study illustrated that children's participation in DRR can lead to long-term behavioural changes that support resilience-building efforts within communities. As children became more aware of disaster risks and preparedness strategies, they also developed a sense of responsibility toward protecting themselves and others from potential hazards. This shift in attitude, from passive to proactive, is one of the most significant outcomes of the study, demonstrating that design probes are not only effective in educating children about disaster risks but also in fostering a mindset of resilience that will serve them throughout their lives. The outcomes of this research contribute to a growing body of evidence supporting the importance of child-centred approaches in DRR, demonstrating that children, when equipped with the right tools and knowledge, can play a critical role in promoting disaster resilience within their communities. By engaging children as active participants in DRR, design probes not only enhance individual preparedness but also their use in participatory DRR education, suggesting the potential for broader influence, particularly in shaping household- and community-level discussions about disaster risk. By engaging children as active participants in DRR, design probes can support preparedness efforts beyond individual learning, contributing to a shared awareness and dialogue that reinforces a culture of safety and resilience.

7.3. DISCUSSION: IMPLICATIONS FOR PRACTICE AND POLICY

The findings from this study offer significant insights into enhancing DRR efforts by emphasising the role of children's voices and their creative engagement. Traditional approaches to DRR, including school drills and informational sessions, have been the backbone of disaster preparedness education for years.

However, the outcomes of this study bring attention to the need for more dynamic, engaging, and child-centred approaches. The design probes introduced in this research emerged as powerful tools that not only inform and inspire children about disaster preparedness but actively engage them, fostering a deeper, more personal connection to DRR principles. Similar approaches have been developed, such as those introduced by Save the Children, which advocate for participatory, play-based, and experiential learning approaches to enhance children's disaster awareness and preparedness (Save the Children, 2020). These initiatives have demonstrated that when children are actively involved in disaster education—through role-playing, storytelling, and problem-solving activities, they develop stronger coping mechanisms and a greater sense of agency in disaster scenarios. The implications extend to both practice and policy, highlighting the need for educators, disaster management professionals, and policymakers to rethink how children are integrated into DRR initiatives.

7.3.1. A UNIQUE APPROACH TOWARDS DRR

This study demonstrates how a predominantly bottom-up design, lightly scaffolded by brief, designer-defined prompts, extends DRR education beyond procedural drills. Whereas drills efficiently transmit standard responses, the probes foregrounded children's locally grounded meanings and family-specific adaptations. The minimal scaffolding acted as a nudge into self-directed discovery and learning, engaging cognitive and emotional processes while preserving clarity, safety, and age-appropriate pacing.

Building on this bottom-up emphasis, the design probes in this research provided a transformative method for disaster preparedness, offering a compelling contrast to conventional practices. Traditional school-based drills, while necessary for procedural learning, often fall short of engaging children emotionally or critically in understanding DRR (Ronan et al., 2010). The design probes, by contrast, introduced narrative-driven activities that allowed children to explore disaster preparedness concepts in an emotionally resonant and

personally meaningful way. This approach aligns with Paton's (2019a) argument that educational strategies should go beyond information delivery to actively engage cognitive and emotional processes.

The probes encouraged children to reflect on disaster scenarios, express their ideas, and provide solutions in creative, playful ways. This interactive method not only enhanced their understanding of disaster risks but also fostered a sense of responsibility toward disaster preparedness. Children who participated in these activities showed a marked shift from being passive learners to proactive participants, demonstrating ownership of the knowledge they gained and applying it to their immediate environments. This outcome underscores the potential for design probes to cultivate long-term resilience in children, as Peek et al. (2018) suggest, by engaging them early in disaster education.

The use of creativity and play as integral components of the learning process allowed children to connect emotionally with DRR concepts, making the lessons both impactful and memorable. As a result, this study highlights the need to consider DRR not only as a set of procedures but as an educational journey that engages children intellectually, emotionally, and socially.

7.3.2. IMPLICATIONS FOR PRACTICE

The implications for practice arising from this research demonstrate the value of making DRR education more engaging and child-centred. Design probes, with their combination of interactive playful activities, provided children with a learning experience that was both enjoyable and intellectually stimulating. This suggests that alternative and more nuanced approaches to disaster preparedness education should be integrated into regular curricula as an ongoing element, rather than an isolated event such as an annual drill. By incorporating child-friendly DRR education into everyday learning, the outcomes can be more sustainable, as children will then not only retain the knowledge but also apply it beyond the classroom.

A significant practical outcome of this research was the observed shift in children's engagement with the concept of disaster preparedness. The probes encouraged them to engage in critical thinking, reflect on disaster risks within their immediate environments, and take proactive steps in sharing their knowledge and findings with their families. The ripple effect of this learning process, children sparking conversations and discussions about preparedness at home, demonstrates how educational tools like design probes can extend their impact to families and communities. Rather than replacing existing school-based DRR efforts, this approach offers a complementary pathway that engages children in a more exploratory, self-directed manner. This speaks to the broader potential of integrating similar tools into community programs, after-school activities, and family-oriented events, fostering a culture of preparedness that extends beyond the classroom.

Another critical implication for practice is the necessity for structured learning approaches that gradually build children's confidence. The design probes allowed children to progress from simple disaster scenarios to more complex discussions, ensuring that they were not overwhelmed by the information. This approach helped build their self-confidence and reinforced their ability to apply what they learned to real-world situations. Schools and educational systems could benefit from adopting similar modular learning formats as an addition to their DRR programs, starting with basic risk assessment and awareness and advancing to more detailed preparedness strategies, thereby providing a comprehensive and engaging learning experience.

7.3.2.1 FOSTERING A SENSE OF COLLECTIVE RESPONSIBILITY

One of the significant outcomes of this research was the profound shift in how children perceived their roles in disaster preparedness. Through their engagement with the design probes, children came to realise that their actions, as well as those of their immediate surroundings, particularly their families, can

significantly impact disaster resilience. This internalised sense of agency highlights a transition from merely individual responsibility to a more profound awareness of how they can influence the safety and preparedness of themselves and their families and loved ones.

The design probes helped foster a strong sense of empowerment within children, conveying the message to them that they can be active contributors to their environments. The activities inspired children to recognise their ability to affect real change, not only for their own safety but for those around them. This recognition extended to understanding that their small actions, whether starting a conversation at home about preparedness or learning to identify risks, can strengthen the preparedness of their families and communities. This outcome underscores the importance of nurturing a sense of agency in children through DRR education, where they realise that their contributions matter and that they have the power to make tangible improvements in their immediate environments.

In practice, this suggests that disaster preparedness programs should bring more focus to the development of individual responsibility within the context of familial and close relational networks. Rather than focusing solely on broad community efforts, the findings suggest that the most impactful changes begin at home, with children becoming catalysts for increased awareness and action within their households. As children adopt their role in disaster preparedness, this spark of responsibility can grow, potentially inspiring lifelong habits of preparedness and resilience.

This approach could be transformative, especially if policymakers and educators invest in such initiatives that foster these early realisations in children. By planting the seeds of responsibility and action in young minds, societies can build stronger foundations for future disaster resilience. These children are not just learning for today, they represent the future, and their early experiences in DRR can inspire them to create more disaster-resilient societies tomorrow. In this

way, the initiatives explored in this study have the potential to create long-lasting change, where children grow into informed, proactive adults, contributing to more resilient societies in the future.

7.3.2.2 BUILDING CONFIDENCE THROUGH STRUCTURED LEARNING

A central focus of this study was to design a set of activities that not only conveyed important information but also sustained engagement and interest through thoughtful design, both aesthetically and from a content perspective. One of the key outcomes of this approach was the ability to build children's confidence in understanding and discussing disaster preparedness. The structured, progressive introduction of more complex tasks and scenarios allowed participants to master key concepts at a pace suited to their cognitive development. This structured learning helped ensure that children processed information without feeling overwhelmed, empowering them rather than intimidating them when faced with the topic of disasters.

Crucially, the design of the activities aimed to be fun, playful, game-like, and engaging, which successfully captured and sustained the participants' interest and motivation throughout the study. This was reflected in the participants' repeated expressions of enjoyment during their interactions with the probes. The pre- and post-test interviews provided further evidence of the effectiveness of this approach, as participants not only demonstrated a significant increase in their knowledge and understanding of disaster contexts but also showed greater confidence in their ability to take meaningful action. The playful and exploratory nature of the design probes meant that children learned through discovery, often without realising that they were learning. This bottom-up, hands-on approach contrasted with more traditional, top-down educational methods, enabling the children to develop a deeper understanding of the material while enjoying the process.

Moreover, the individual setting in which the probes were applied, played a crucial role in fostering this confidence. Unlike traditional school or classroom environments, where children might feel pressured or constrained, the participants engaged with the probes in familiar, relaxed spaces such as their homes, at a friend's sleepover, or at their grandparents' house. These comfortable environments allowed the children to explore the topics more deeply, be their authentic selves, and share their perspectives and opinions more freely. This sense of security and comfort in a friendly setting contributed significantly to boosting their confidence in approaching the topics of disaster preparedness and resilience. By contrast, more formal educational settings might not offer the same level of freedom or personal expression, which could limit children's willingness to engage fully or share their insights.

The study's findings suggest that similar structured learning approaches should be incorporated into broader DRR education programs. The gradual introduction of concepts, starting with basic preparedness and progressing to more advanced activities, provided a gradual knowledge-building framework that not only fostered learning but also significantly boosted children's confidence in doing so. This structured yet engaging model can serve as a blueprint for schools and educational programs, where a multi-phase disaster education curriculum could follow a similar path. Such programs would not only teach essential preparedness skills but also give children the confidence to act on what they have learned in real-world situations. This approach suggests and reconfirms that when children are having fun, they are more likely to engage deeply with the content, internalise the lessons, and develop the confidence necessary to translate their knowledge into meaningful action.

7.3.3. IMPLICATIONS FOR POLICY

From a policy perspective, the study's outcomes bring attention to the importance of recognising children as active contributors to disaster resilience. Traditionally, children have been viewed as passive recipients of DRR education,

but this research clearly demonstrates that when equipped with the right tools and opportunities, children can play a proactive role in influencing their households' and communities' preparedness. This suggests that policy frameworks for DRR should be revisited and revised to include more child-centred approaches that empower young learners to participate meaningfully in preparedness efforts (R. A. Hart, 2013; Le Dé et al., 2021).

The empowerment of children as active participants in DRR is a critical outcome that holds broader policy implications. Policymakers should prioritise child-centred strategies in national disaster preparedness plans, ensuring that schools and community organisations are equipped with the resources and training necessary to engage children effectively. By incorporating tools like design probes into DRR curricula, children can be recognised as capable agents of change who contribute not only to household preparedness but also to community resilience on a larger scale.

As the findings of this study have showcased, using design probes to engage children in tackling complex and wicked problems, such as disasters, is not only necessary but also timely and effective. This approach goes beyond traditional methods, allowing children to interact with disaster scenarios in a way that feels personal and relatable. More importantly, this method can be applied to broader contexts, such as sustainability, environmental change, and other pressing global challenges. However, it is especially crucial in the context of disasters, given the increasingly disaster-prone world we live in. Now more than ever, personalised, customised, and relatable initiatives like the design probes used in this study are vital in encouraging children to take an active step forward in the decisions and solutions that may profoundly affect their very own lives.

This focus on empowering children and providing them with the tools to engage actively in DRR also reinforces the need for broader policy actions that focus on inclusivity and personalised education. The study's findings suggest that DRR

policies should aim to create space for children's voices in disaster-related decision-making and should promote a more inclusive approach that aims to capture and value their perspectives. Involving children in this way not only builds their individual resilience but also contributes to the creation of more disaster-resilient societies that are better prepared for the challenges of the future. Policymakers should, therefore, consider integrating child-centred, personalised educational tools like design probes into broader national disaster strategies, ensuring that the next generation is not only prepared for disasters but also empowered to contribute to the resilience of their communities.

7.3.4. A COMPLEMENT TO TRADITIONAL DISASTER DRILLS AND COMPARISON WITH INTERNATIONAL STUDIES

Design probes, as introduced in this study, serve as a valuable complement to traditional disaster drills. While drills are essential for teaching children procedural responses in emergencies, they often fail to engage children in the underlying principles of DRR in a meaningful way (Johnson et al., 2014). Traditional drills typically focus on rehearsing specific actions during disasters, such as evacuation protocols and safety procedures, without necessarily fostering a deeper understanding of the causes, implications, and broader context of disasters. Moreover, they often do not provide children with opportunities to reflect on how human actions and environmental factors can influence the magnitude and impact of disasters.

Design probes address these gaps by offering a more holistic, interactive, and personal approach to disaster preparedness. By integrating narrative-driven elements, creativity, and hands-on activities, design probes actively engage children on intellectual, emotional, and cognitive levels. This study's findings demonstrate that children who participated in these activities developed a stronger grasp of complex DRR concepts, which they were able to relate to their personal lives and communities. Through play and reflection, children explored

how human actions contribute to disaster risk and resilience, creating a sense of personal responsibility toward disaster preparedness (Johnson et al., 2014).

Engaging children in DRR through such personal, customisable, and relatable methods has broader implications that extend beyond individual learning. The research findings suggest that this type of engagement can significantly benefit not just children but also their communities today and into the future. Children who are empowered with knowledge and a sense of agency in DRR are more likely to act as catalysts for change within their households and social circles. As demonstrated by this research, children who participated in design probe activities often shared their learning with their families, sparking critical conversations about preparedness and risk management at home. This ripple effect contributes to a culture of preparedness that extends beyond the classroom, helping to build more disaster-resilient families and communities (Peek et al., 2018).

Moreover, by fostering a deeper understanding of DRR at an early age, this approach equips children with the tools and mindset needed to navigate disaster risks throughout their lives. The study demonstrates that design probes not only prepare children to act in the event of a disaster but also implant the long-term skills and attitudes necessary for building resilience as individuals and community members. Bridging the gap between knowledge and action is essential for creating sustainable resilience in communities, and early educational interventions like this play a pivotal role in this process (J.-C. Gaillard & Mercer, 2013).

When viewed against wider national and international research, these findings reaffirm a broader shift toward participatory and child-centred approaches to disaster education. In New Zealand and Australia, studies such as those by Ronan and Johnston (2005) and Towers et al. (2016) have demonstrated the importance of school-based and curriculum-led DRR education, often achieving

gains in awareness and family preparedness. However, such approaches tend to remain adult-designed and procedural in nature. Internationally, research across Asia and the Pacific has begun to introduce more creative, narrative, and culturally grounded forms of engagement, signalling an important step toward participatory learning (Haynes & Tanner, 2015a; Hidayati, 2020; Rahiem & Rahim, 2020).

The present research builds on this foundation by advancing a design-led, bottom-up approach that enables children to become co-creators of knowledge rather than recipients of instruction. Through playful and reflective exploration, children engaged in design-probe activities that prompted self-directed learning, critical reflection, and family-level discussions about preparedness, addressing the engagement and transfer gaps noted in earlier DRR studies. Table 7 provides a concise summary of how this study aligns with and diverges from other national and international research, highlighting its contribution in operationalising participatory principles through creative design methods that bridge individual learning, intergenerational communication, and community resilience.

Table 7. Comparative summary of national and international child-centred DRR studies.

Country	Study (Year)	Method / Focus	Key Outcomes	Similarity / Difference to This Study
New Zealand	Ronan & Johnston (2005–2010)	School-based DRR education and family preparedness transfer	Improved child and household preparedness; intergenerational learning	Shares the goal of strengthening family communication but advances it through creative, reflective activities rather than procedural drills.
Australia	Towers et al. (2020)	Child-centred DRR and Resilience Education frameworks	Greater engagement and resilience in school settings	Aligns in promoting active participation; extends this by using design-driven tools outside formal schooling contexts.
Indonesia	Rahiem (2020)	Folklore and storytelling for early-childhood DRR	Enhanced comprehension and cultural relevance	Resonates in its narrative emphasis but adds material-making and discovery through artefacts.
Indonesia (Lombok)	Hidayati (2020)	Local storytellers facilitating preschool DRR	High engagement and cultural fit	Similar in valuing play and local context; differs through independent, child-led exploration rather than facilitator-led sessions.
Philippines	Haynes & Tanner (2015)	Participatory video with youth	Youth articulated social dimensions of risk and resilience	Conceptually parallel in fostering youth voice and co-creation; applies a lighter, design-based method suited to younger children.
Taiwan	Lin et al. (2013)	Game-based DRR learning	Improved recall and motivation	Shares play-based learning principles; contrasts by prioritising open-ended meaning-making over rule-based gaming.
Multi-country	Amri et al. (2018)	Systematic review of CCDRR initiatives	Call for participatory, locally grounded DRR education	Directly responds to this call by operationalising participatory engagement through design probes.
Global (Review)	Johnson et al. (2014)	Review of children’s learning in DRR education	Identified lack of emotional engagement and practical transfer	Addresses this gap through playful, reflective methods that link learning to family and community action.
United States	Peek & Tobin-Gurley (2016)	Creative methods (photo-elicitation, mapping) with youth	Deepened youth understanding and agency post-disaster	Shares creative participatory ethos; applies it proactively to preparedness rather than post-disaster contexts.
New Zealand (This Study)	Mosavat et al., (2025)	Design-led, child-centred DRR using interactive design probes	Enhanced understanding, agency, and intergenerational learning; movement toward child-initiated participation	Builds on and extends earlier participatory DRR work by introducing design-based, bottom-up methods that foster children’s self-directed discovery, bridging engagement, reflection, and real-world household impact.

7.3.5. BROADER IMPLICATIONS

The broader implications of this research stress the evolving perceptions of children in the context of DRR. Increasingly, literature points to a shift in viewing children not just as passive recipients of knowledge but as capable, proactive participants in disaster resilience efforts (Change, 2012; Dé et al., 2020; Peek, 2008a; Peek et al., 2018). While this shift is gaining momentum, there is still significant room for further initiatives that move away from traditional, top-down educational methods. The success of the design probes in this study demonstrates the need for more innovative, child-centred approaches that actively engage children in meaningful ways.

The findings suggest that children, when provided with creative, reflective, and emotionally engaging tools like carefully designed set of probes, can transcend the role of passive learners. Instead, they become active contributors, influencing their families and communities. This shift aligns with global frameworks such as the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015), which emphasises the importance of inclusive approaches that involve all members of society, including children. Integrating children more fully into disaster preparedness efforts fosters a culture of resilience that spans generations. Early involvement in DRR equips children with the skills, knowledge, and confidence they need to understand and navigate disaster risks throughout their lives (Amri et al., 2018; Krishna et al., 2022).

Furthermore, the application of design probes in this study demonstrated significant potential in exploring and addressing complex, multi-faceted problems such as disasters. The success of this approach as demonstrated in this study, shows that design probes could be adapted to other pressing global issues, including sustainability, poverty reduction, and climate change education. These tools offer an accessible, engaging, customisable, and participatory method for addressing multifaceted challenges by making them

relatable and encouraging children to explore solutions through creativity and critical thinking.

While the shift in perceiving children as active participants in DRR is increasingly reflected in the literature, there remains a significant opportunity for further initiatives to build on this foundation. Programs like the design probes introduced in this study show how powerful child-centred, participatory methods can be. By embracing this approach, not only can disaster preparedness education be enhanced, but these methods can also be applied to a broader range of complex global challenges. This path forward has the potential to cultivate more resilient, sustainable, and engaged societies, driven by the participation and empowerment of younger generations.

7.4. LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

While this research has made significant contributions to understanding how design probes can engage children in DRR, several limitations must be acknowledged. Addressing these limitations can provide clearer insights and lay the groundwork for future research, ensuring more effective tools and approaches in DRR education

7.4.1. AGE-FOCUSED CONSIDERATIONS

One of the key limitations of the study was the diverse age range of participants, which created variability in how children interacted with and understood the design probes. Children's cognitive, emotional, and developmental stages significantly impact their ability to comprehend complex disaster preparedness concepts. The younger participants may have found some of the activities too abstract or difficult to relate to their personal experiences. Conversely, older participants could have benefitted from more complex and challenging content that would stimulate deeper critical thinking and problem-solving.

Future research should consider age-specific versions of the design probes that are developmentally appropriate for different age groups. For example, younger children could be introduced to DRR concepts through simplified narratives and hands-on activities that focus on familiar experiences, while older children could be given more complex scenarios that require critical thinking and collaborative problem-solving. By tailoring the content and activities to the cognitive abilities of each age group, researchers can ensure that all participants are engaged and able to fully grasp the educational material.

7.4.2. TOOL-RELATED CHALLENGES: ACCESSIBILITY AND INCLUSIVITY

One of the key limitations in this study was the lack of tailored adaptations in the design probes to accommodate the varied needs, abilities, and learning preferences of children. While the probes were generally effective in engaging children in disaster preparedness, they did not consider the diverse range of physical, cognitive, and emotional abilities that exist among participants. For instance, children with sensory processing challenges or learning disabilities may have faced difficulties engaging with the materials in the same way as their peers. Similarly, children from different cultural or linguistic backgrounds could have encountered challenges in fully understanding the concepts presented due to language barriers or culturally unfamiliar references.

To address these limitations, future iterations of design probes should place a stronger emphasis on accessibility and inclusivity. This could involve the development of multisensory tools that engage children through a combination of tactile, auditory, and visual elements, making the materials more appealing to children with varying sensory needs. For children with cognitive disabilities, simplified or adapted materials could be introduced to ensure that core disaster preparedness concepts are communicated in a way that is easier to comprehend. Additionally, providing language support and culturally adapted materials would allow children from diverse backgrounds to connect with the

content more effectively, making the learning experience more relevant to their personal contexts.

Moreover, making the tools more accessible for children with physical disabilities, such as those with visual or hearing impairments, would enhance the inclusivity of the educational approach. This could be achieved by incorporating larger text formats, voice-guided instructions, or visual aids that cater to specific needs. Ensuring that the design probes are available in a range of formats would also help address the needs of children requiring additional support, making disaster preparedness education more equitable. Future research should focus on creating customisable, inclusive design probes that enable children to interact with disaster risk reduction content in ways that are comfortable and meaningful for them. By doing so, disaster preparedness education can become not only more effective but also more equitable, ensuring that all children, regardless of their abilities or backgrounds, are given the opportunity to actively participate in building resilience.

7.4.3. SIBLING AND PARENTAL INFLUENCE AND IMPOSED BIASES IN INTERVIEWS

During data collection, some interviews were conducted with siblings present or with parental oversight, which introduced bias into the responses. In some instances, participants deferred to their sibling's answers, agreeing with them rather than providing their own perspective. This influenced the data's reliability, as the responses did not always reflect independent thought. Additionally, the presence of parents during interviews sometimes led to further bias, with parents either answering questions for their children or rephrasing questions in a way that prompted certain responses. This dynamic, while sometimes helpful in clarifying questions, also hindered children's ability to express their own views freely and authentically.

To mitigate this limitation, future research should aim to conduct interviews with participants individually and without parental presence, allowing children to share their perspectives uninfluenced. Separate scheduling for siblings would further encourage independent thinking and reduce the likelihood of one child's responses affecting another's. Additionally, providing instructions to parents to remain passive during interviews without intervening could ensure more accurate and unbiased data collection.

7.4.4. THE IMPACT OF THE COVID-19 PANDEMIC

The global COVID-19 pandemic presented one of the most significant challenges to this research. Lockdowns and social distancing measures severely restricted the ability to conduct in-person data collection, leading to delays and limited access to participants. Recruitment, particularly through schools and community centres, became nearly impossible as these institutions were closed for extended periods. As a result, many interviews had to be conducted online, which introduced additional complications, such as scheduling conflicts, technical difficulties, and reduced engagement from participants.

The pandemic's broader impact on the research process also limited the effectiveness of the design probes, which were intended to be hands-on, interactive tools. Originally designed for a group setting, the research had to adapt to being an individual experience for each participant. While this shift was challenging, it also provided opportunities to understand how children engaged with the probes independently, offering unique insights into their personal reflections and learning processes without the influence of group dynamics.

Engaging children online also presented challenges that could not fully replicate the in-person experience. Despite technological challenges such as internet connectivity issues, sound disruptions, or video problems, the online format proved successful in offering participants an added sense of comfort and calm, as they could engage from the familiarity of their own homes. Future research should develop more flexible approaches to accommodate similar challenges.

For example, hybrid research models that combine in-person and remote engagement could provide more adaptable and resilient methods for conducting research, particularly during global crises like pandemics. Additionally, creating digital versions of the design probes could ensure that participants are able to engage with the tools regardless of external constraints.

7.4.5. TECHNOLOGICAL INTEGRATION AND DIGITAL TOOLS

The decision to use traditional, paper-based design probes was made with the intention of providing a hands-on, physical experience that would be memorable for children. However, in an increasingly digital world, this approach presents limitations. Many children are more accustomed to interacting with digital tools, and some participants lost the physical materials, reducing the effectiveness of the engagement. One participant, for example, misplaced their booklet before being able to return it to the researcher, highlighting the practical challenge of using physical tools.

While the paper-based approach was intended to provide a break from the digital world, future research should consider integrating digital tools or creating a hybrid "phygital" approach that combines both physical and digital elements. A digital version of the design probes could allow children to interact with the content more easily, perhaps through quizzes, simulations, and real-time feedback. These digital tools would also allow for the content to be updated regularly and personalised based on the child's specific circumstances, such as geographic location or individual risks. Furthermore, gamification elements, such as rewards or badges for completing tasks, could increase motivation and engagement over time, making the learning process more dynamic and interactive. Future studies should explore how digital or hybrid tools impact children's learning outcomes, and whether they can make DRR concepts more accessible and engaging for a generation of digital-native learners.

It would also be well worth exploring the potential role of Artificial Intelligence in the future applications of design probes. AI could extend probe studies in various ways, including supporting adaptive prompting, personalised feedback, and more sustained engagement over longer periods of time. For example, personalised companion avatars or conversational agents could be designed to act as supportive “prompting partners,” encouraging children to elaborate on their ideas, reflect more deeply, and stay motivated throughout the study. Such tools may also help address common challenges of probe-based research, such as inconsistent participation, varying confidence or literacy levels, and limited opportunities for follow-up, while still retaining the reflective and exploratory intent of the method. Future research should examine how AI-enabled approaches influence children’s experiences, participation, and learning, and under what conditions these tools can be integrated ethically and safely within child-centred DRR contexts.

7.4.6. LONG-TERM RESILIENCE BUILDING

While the design probes were successful in increasing children’s immediate understanding of disaster preparedness, one of the study’s limitations was its focus on short-term outcomes. The research did not assess how well participants retained disaster preparedness concepts over time, nor whether they applied their new knowledge to long-term resilience strategies. Building resilience is not just about responding to a single event; it involves creating systems and behaviours that help individuals and communities cope with multiple disasters or prolonged crises. To address this limitation, future research should incorporate follow-up studies or longitudinal research designs to assess the long-term retention of DRR concepts. This could include monitoring how children’s understanding of disaster preparedness evolves and whether they continue to apply the knowledge and skills gained from the design probes. A focus on long-term resilience could also include modules that help children develop habits and strategies for maintaining preparedness year-round rather than just in anticipation of a single disaster event.

7.5 CHAPTER SUMMARY

This chapter synthesises the study's findings to demonstrate how design probes can reframe children's engagement with DRR. It contrasts the limitations of conventional, drill-based, top-down approaches, where children are largely positioned as passive recipients of procedural instructions, with a more participatory, creative model that invites exploration, reflection, and dialogue. By revisiting the research questions, the chapter demonstrates how the probes enabled children to move from knowing about disasters in abstract terms to actively making sense of risk in relation to their homes, families, and everyday environments, and to share this evolving understanding with others.

The chapter highlights several areas where this approach proved particularly effective. Playful, narrative-driven, and visually engaging activities supported children's creative expression, critical thinking, and emotional investment in DRR, deepening their understanding of preparedness, vulnerability, and resilience. Children initiated conversations at home, influenced family emergency planning, and began to see themselves as capable of contributing to safety within their households and social circles. In doing so, the study shows that well-crafted, child-centred probes can complement traditional drills by fostering ownership, agency, and intergenerational learning, with clear implications for practice and policy.

At the same time, the chapter acknowledges important constraints and areas needing refinement. Variations in age, abilities, and contexts affected how children engaged with the probes, and the paper-based, individual format, shaped in part by COVID-19 disruptions, limited opportunities for group interaction and long-term tracking of behaviour change. Challenges such as accessibility, inclusivity, sibling and parental influence during data collection, and the study's short-term nature are identified as priorities for development, including the creation of age-specific versions, more inclusive and "phygital"

(physical–digital) designs, and long-term follow-ups. By outlining these limitations alongside its contributions, the chapter positions design probes as a promising, but still evolving, approach to child-centred DRR, and suggests concrete directions for strengthening resilience-building efforts with and through children.

"Design is content with intent. Content without intent is noise. Intent without content is decoration."

– Joe Sparano



CHAPTER 8 – CONCLUSION

8.1. CHAPTER INTRODUCTION

This final chapter brings together the core insights and key implications drawn from the investigation into the role of design probes in enhancing children's active and creative participation in DRR. Reflecting on the significant findings presented throughout the thesis, this chapter highlights the transformative potential of participatory, child-focused educational approaches. It emphasises the shift from traditional, passive instructional methods to interactive strategies that empower children, enhancing their sense of responsibility, confidence, and agency in disaster preparedness.

The chapter revisits the research's central contributions, particularly demonstrating how design probes have successfully facilitated meaningful engagement, deeper understanding of complex disaster concepts, and more proactive attitudes among children. It explores how children's enhanced understanding and emotional investment can translate into meaningful action, not only individually but also within their households and communities, thus amplifying the impact of DRR education.

8.2. CLOSING REMARKS

This research aimed to explore the ways in which design probes can enhance children's active and creative participation in DRR, contributing to the development of long-term resilience. The findings demonstrate that, by moving beyond traditional methods such as school drills, design probes can create an engaging and personal learning experience. These tools supported children to not only grasp essential DRR concepts but also internalise them in a meaningful and memorable way. Whereas conventional drills focus primarily on procedural responses, the design probes created opportunities for children to explore disaster preparedness through narrative, creativity, and hands-on activities that

foregrounded empowerment and agency in their exploration and discovery of disaster-related concepts. This approach helped make complex disaster concepts more accessible and connected to children's everyday lives, fostering a stronger sense of responsibility and agency.

The study also found that children who participated developed a deeper understanding of disaster preparedness and a clearer sense of their own role in resilience efforts. Rather than being passive recipients of information, children were actively engaged in the learning process, expressing ideas, concerns, and solutions in creative and constructive ways. This aligns with broader global strategies, such as the Sendai Framework for Disaster Risk Reduction, which emphasises the importance of including all members of society, especially children, in building resilience (UNISDR, 2015). Through this participatory approach, children became better prepared to respond to disasters themselves. Also, they demonstrated the capacity to influence their families and communities, reinforcing the ripple effect that child-centred DRR education can create.

The results further highlighted the importance of adapting disaster preparedness tools to suit children's diverse needs and backgrounds. While the use of physical, paper-based probes was intended to provide a break from the digital world and offer a tactile, memorable experience, the study indicated that a hybrid approach blending physical and digital elements could improve accessibility and effectiveness. In an increasingly digital world, children may find it easier and more familiar to engage with preparedness tools on devices, which can also address practical challenges such as the loss of physical materials, as demonstrated in one case in which a participant lost the booklet before returning it to the researcher. Offering digital versions of the probes or a customisable "phygital" approach could therefore reduce logistical issues while widening access to a broader range of participants.

The study also revealed that children often took what they learned from the design probes back to their homes, initiating discussions about disaster preparedness with their families. This outcome points to the wider societal impact that child-centred DRR education can have. Children empowered with DRR knowledge can act as catalysts for preparedness in their households and communities, spreading awareness and encouraging action beyond the immediate learning environment. This ripple effect plays a crucial role in fostering a culture of preparedness that extends across communities and supports stronger, more disaster-resilient societies.

Ultimately, this research contributes to the growing understanding of child-centred DRR education by showing that participatory and adaptable methods, such as design probes, can enhance children's involvement, understanding, and roles in preparedness and resilience-building efforts. These findings have important implications for policy and practice. By recognising children as active participants, policymakers can shape more inclusive DRR strategies that empower younger generations and incorporate their voices and ideas into resilience-building efforts.

Educational frameworks may also benefit from adopting similar participatory tools and integrating them into school curricula and community programmes to support more robust, child-inclusive disaster preparedness initiatives. Such integration can foster a culture of resilience that extends from children to families and communities, strengthening disaster readiness at multiple societal levels. At the same time, the findings should be read within the study's boundaries, particularly the scale and context of the participant group, and the short-term nature of the intervention. There were also practical and methodological tensions, including the trade-off between the value of tactile, paper-based probes and the accessibility and logistical advantages of digital formats, as well as instances where interview conditions (e.g., parental or sibling

presence) may have shaped responses. These considerations are discussed in detail in Chapter 7, and they directly inform the future directions outlined below. Building on the limitations and recommendations developed in Chapter 7, future research can test design probes at a larger scale and across different contexts, examine longer-term retention and behavioural uptake through longitudinal follow-up, and further explore inclusive and hybrid (“phygital”) formats, including the potential role of digital and AI-enabled approaches, in ways that remain safe, ethical, and child-centred.

Most importantly, this thesis contributes to theory by making explicit how design probes operate as a participatory learning mechanism within child-centred DRR. In theoretical terms, the research advances existing understandings in three key ways. First, it positions probes not simply as data-collection artefacts, but as an intervention that enables children’s meaning-making through narrative, play, and creative production, supporting both cognitive understanding and affective engagement. Second, it refines how “empowerment” can be understood in DRR education by evidencing a pathway from engagement and reflection to expressed agency and solution-oriented thinking, including children’s capacity to extend preparedness discussions into households. Third, it contributes a design-led framing of child participation in DRR that aligns participatory education theory with disaster preparedness practice, showing how carefully scaffolded, child-focused tools can move children beyond procedural compliance toward active contribution and shared responsibility. Together, these contributions clarify what new knowledge this thesis adds and how it advances theoretical discussions at the intersection of participatory design, child agency, and DRR education.

SUPPLEMENTARY MATERIALS

APPENDIX #1 – RESEARCH ETHICS APPROVAL



Auckland University of Technology Ethics Committee (AUTEC)

Auckland University of Technology
D-88, Private Bag 92006, Auckland 1142, NZ
T: +64 9 921 9999 ext. 8316
E: ethics@aut.ac.nz
www.aut.ac.nz/researchethics

AUT

TE WĀNANGA ARONUI
O TĀMAKI MAKĀU RAU

10 March 2022

Ricardo Sosa
Faculty of Design and Creative Technologies

Dear Ricardo

Re Ethics Application: **21/436 Promoting Children's Creative Participation in Disaster Risk Reduction**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years u

ntil 10 March 2025.

Standard Conditions of Approval

1. The research is to be undertaken in accordance with the [Auckland University of Technology Code of Conduct for Research](#) and as approved by AUTEC in this application.
2. A progress report is due annually on the anniversary of the approval date, using the EA2 form.
3. A final report is due at the expiration of the approval period, or, upon completion of project, using the EA3 form.
4. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form.
5. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.
7. It is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard and that all the dates on the documents are updated.
8. AUTEC grants ethical approval only. You are responsible for obtaining management approval for access for your research from any institution or organisation at which your research is being conducted and you need to meet all ethical, legal, public health, and locality obligations or requirements for the jurisdictions in which the research is being undertaken.

Please quote the application number and title on all future correspondence related to this project.

For any enquiries please contact ethics@aut.ac.nz. The forms mentioned above are available online through <http://www.aut.ac.nz/research/researchethics>

(This is a computer-generated letter for which no signature is required)

The AUTEC Secretariat
Auckland University of Technology Ethics Committee

Cc: mojan.mosavat@autuni.ac.nz; loic.le.de@aut.ac.nz

APPENDIX #2 – KIT V1



HI THERE, MY NAME IS AZAN, I LIVE ON ANOTHER PLANET FAR AWAY FROM EARTH. IT'S SO NICE TO MEET YOU!

EVEN THOUGH I LIVE SO FAR AWAY FROM YOU, THERE IS SURELY ONE THING WE HAVE IN COMMON. SOMETIMES ON OUR PLANET DISASTERS HAPPEN LIKE QUAKES AND FLOODS.

TELL ME, WHAT DOES 'DISASTER' MEAN ON PLANET EARTH?

.....

I AM ALSO SPECIALLY UNLUCKY WHEN IT COMES TO DISASTERS HAPPENING AROUND ME. YOU'LL SEE AS YOU KEEP ON PLAYING THE GAME.

BUT I REALLY WISH TO BE ABLE TO MAKE THE BEST OUT OF EVERY SITUATION AND HELP OTHERS AROUND ME. I HAVE A PLAN TO MAKE THE BEST DECISIONS TO HELP MYSELF AND THE PEOPLE I LOVE.

UNFORTUNATELY, YOU SEE, I HAVE A REPUTATION OF BRINGING BAD LUCK. BUT, WITH YOUR HELP I WANT TO MAKE CHANGES AND BECOME THE HERO IN OUR COMMUNITY.

1

OH WOW!

SPEAKING OF GETTING TO KNOW EACHOTHER BETTER. QUICK NOTE ABOUT ME, I LEARN A LOT BETTER WITH PICTURES. SO, CAN YOU DRAW A MAP OR A PICTURE OF YOUR NEIGHBORHOOD? WHAT DO NEIGHBORHOODS LOOK LIKE ON EARTH? AND HOW WELL DO YOU KNOW YOUR SURROUNDINGS?



DRAW A MAP HERE

CAN YOU WALK ME THROUGH THE MAP OR PICTURE YOU DREW? DO YOU KNOW WHERE IS SAFE AND WHERE IS DANGEROUS TO GO IF A DISASTER HAPPENS?

.....

.....

.....

.....

.....

3

SO IF YOU ARE INTERESTED IN HELPING ME, FOLLOW ME ALONG AND HELP ME SAVE THE DAY!

BUT HEY! ENOUGH ABOUT ME.

TELL ME A LITTLE BIT ABOUT YOURSELF. HAVE YOU EVER EXPERIENCED A DISASTER? IF SO, CAN YOU DRAW A MAP IN THE SPACE BELOW, AND SHOW ME ON THE MAP WHERE YOU EXPERIENCED A DISASTER?

TELL ME MORE, WHAT HAPPENED? AND WHAT DID YOU DO?!



DRAW A MAP HERE

TELL ME WHAT HAPPENED!

.....

.....

.....

.....

.....

2

WOW! SO NOW THAT I KNOW YOU A LITTLE BETTER, LET ME GIVE YOU A TOUR OF WHERE I LIVE.

USUALLY YOU CAN FIND ME EITHER AT HOME IN OUR LIVINGROOM OR MY BEDROOM. OF COURSE, WE HAVE SCHOOLS HERE ON OUR PLANET AS WELL.

I ALSO REALLY ENJOY TAKING A WALK IN THE PARK ON MY WAY TO SCHOOL OR ON MY WAY BACK HOME!

WELCOME! THIS IS OUR LIVINGROOM, IT HAS A DOOR TO MY BEDROOM AS WELL AS OUR FRONT DOOR WITH A NICE ROUND WINDOW WITH A VIEW OF THE PARK!



4

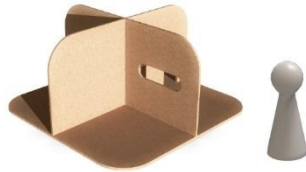
UP NEXT IS MY BEDROOM. IT'S PRETTY COZY IN HERE. I USUALLY PLAY GAMES OR DO MY HOMEWORK IN HERE.



AND FINALLY, THIS IS THE PARK WHERE I HANG OUT WITH MY FRIENDS AFTER SCHOOL. SOMETIMES MY GRANDMA AND I ALSO COME HERE FOR A WALK.

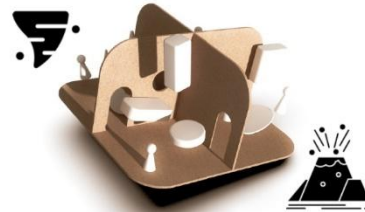


THIS IS OUR CLASSROOM WHICH ALSO HAS A NICE WIDE WINDOW THAT HAS A VIEW OF THE PARK. I REALLY ENJOY SEEING MY FRIENDS AND MY TEACHER HERE EVERYDAY.



NOW YOU KNOW PRETTY MUCH ALL THE PLACES I GO TO. SO HERE COMES THE FIRST THING I'LL NEED YOUR HELP WITH.

LAST TIME THERE WAS A DISASTER, A LOT OF THINGS CHANGES AND WE HAD TO GET SOME NEW FURNITURE AND EVEN PLANT NEW TREES IN THE PARK!



5

6

SURE, EVERYBODY BLAMED EVERYTHING ON NATURE SAYING IT WAS A NATURAL DISASTER WHEN IN FACT, IT IS NOT NATURAL AT ALL! IT IS WHERE PEOPLE BUILD HOMES AND HOW THEY BUILD HOMES THAT CAN CAUSE A DISASTER.

THAT IS WHY IT IS IMPORTANT TO KEEP THAT IN MIND AND TRY AND THINK MORE ABOUT WHERE TO BUILD HOUSES AND HOW TO PLACE THE FURNITURE IN A HOME.

WILL YOU HELP ME MOVE ALL OF THIS STUFF TO THE RIGHT PLACE? HOW DO YOU THINK IT WOULD BE SAFER TO PLACE THE FURNITURE SO THAT THE NEXT DISASTER DOESN'T CAUSE ANY TROUBLE? JUST TRUST YOUR GUT AND GO WITH THE FLOW. YOU CAN CHECK OUT ALL THE ITEMS AND PICK THE ONES YOU THINK SHOULD GO IN EACH ROOM.



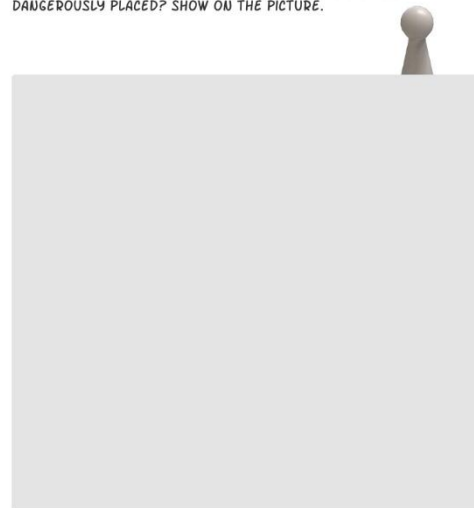
ALSO IF THERE ARE ANY ITEMS YOU DON'T KNOW WHAT TO DO WITH, I CAN RETURN THEM LATER.

THANKS!

WOW! YOU'RE A NATURAL DECORATOR!

SPEAKING OF PLACES I HANG OUT, TELL ME, WHERE ARE THE PLACES YOU USUALLY HANG OUT? WANNA DRAW OR TAKE SOME PICTURES AND SHOW ME? ALSO IN YOUR HOME, WHERE ARE THE SAFE EXITS? SHOW ON THE PICTURES.

DO YOU THINK THERE ARE ANY FURNITURE PIECES THAT ARE DANGEROUSLY PLACED? SHOW ON THE PICTURE.



7

8

OH I SEE! WOW, THE EARTH IS REALLY A BEAUTIFUL PLACE AND YOU HAVE A LOVELY HOME!

BEFORE WE MOVE ON THERE IS SOMETHING I NEED YOUR HELP WITH.

YOU KNOW, ONE OF THE THINGS THAT MY TEACHER SAYS IS VERY IMPORTANT IS KEEPING AN EMERGENCY BAG READY!

I HAVE NO IDEA WHAT I SHOULD PUT IN AN EMERGENCY BAG! CAN YOU HELP ME WITH THIS?

CAN YOU MAKE A COLLAGE OR A LIST OF ITEMS I SHOULD KEEP IN MY EMERGENCY BAG?

THANKS!



MAKE A COLLAGE OR WRITE A LIST OF ITEMS HERE

9

ALRIGHT NOW THAT EVERYTHING IS SET UP, I NEED YOUR HELP WITH SOMETHING ELSE AS WELL.

ONE VERY IMPORTANT THING IN ORDER TO KEEP SAFE AT ALL TIMES IS TO KNOW THE BEST PATHWAYS TO CHOOSE WHEN WALKING OR TRAVELING IN DIFFERENT SPACES.

CAN YOU HELP SHOW ME THE WAY? WHICH WAY DO YOU THINK ITS SAFER TO WALK IN EACH SPACE? WHAT ARE THE IDEAL PATHWAYS?

YOU CAN HELP ME FIND OUT BY PLACING THE NUMBERED CIRCLES (1, 2 AND 3) IN EACH SPACE! THIS WAY I CAN KNOW WHERE TO TAKE MY NEXT STEP IN EACH OF THE ROOMS AND SPACES.



SEEMS LIKE WE'RE ALMOST DONE HERE! THANK YOU SO MUCH, NOW LET'S START THE DAY TOGETHER! I WAKE UP IN MY BEDROOM BUT I HAVE LEARNED THAT EVERY DAY IS UNIQUE AND ANYTHING CAN HAPPEN!

SO, ROLL THE DICES TO SEE WHERE I SHOULD GO NEXT AND WHAT HAPPENS!

THE DICE WITH NUMBERS ON IT TELLS ME HOW MANY STEPS TO TAKE AND THE OTHER ONE TELLS US WHAT HAPPENS! SO WATCH OUT FOR THIS ADVENTURE! ALSO, DON'T FORGET, I NEED YOUR HELP TO MAKE THE BEST DECISIONS AND SAVE THE DAY!

THANK YOU SO MUCH! I REALLY APPRECIATE ALL YOUR HELP!

10

TAKE A PICTURE OF WHERE I AM AND WHAT HAPPENS AND WRITE DOWN YOUR THOUGHTS ON WHAT YOU THINK I SHOULD DO!

ROUND 1



WHAT SHOULD WE DO?
.....
.....
.....

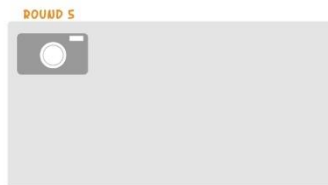
ROUND 2



WHAT SHOULD WE DO?
.....
.....
.....

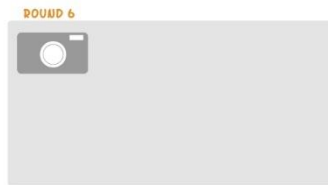
11

ROUND 5



WHAT SHOULD WE DO?
.....
.....
.....

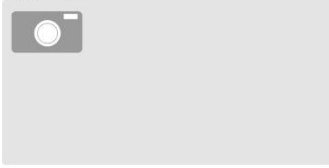
ROUND 6



WHAT SHOULD WE DO?
.....
.....
.....

12

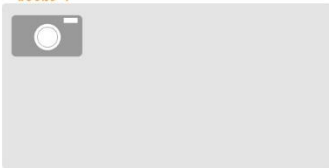
ROUND 3



WHAT SHOULD WE DO?

.....
.....
.....

ROUND 4



WHAT SHOULD WE DO?

.....
.....
.....

WOW! YOU REALLY HELPED ME SAVE THE DAY! NOW EVERYBODY KNOWS ME AS THE HERO IN OUR COMMUNIT!

THANK YOU SO MUCH FOR ALL YOUR HELP! I HOPE I CAN DO THE SAME FOR YOU SOME DAY!

'TILL NEXT TIME, TAKE CARE AND GOODBYE!



13

14

How would you rate this experience?

Age	
Gender	
Area of study	

This experience was engaging and fun.

- Strongly disagree Somewhat disagree Neutral Somewhat agree Strongly agree

This experience made me think about actions I can take for disaster preparedness.

- Strongly disagree Somewhat disagree Neutral Somewhat agree Strongly agree

I am going to talk about this experience with my family and friends.

- Strongly disagree Somewhat disagree Neutral Somewhat agree Strongly agree

This experience inspired me to think about the things I can do to help myself and others around me in time of a disaster.

- Strongly disagree Somewhat disagree Neutral Somewhat agree Strongly agree

This experience inspired me to become aware of my surroundings and identify safe and dangerous places, exits, etc.

- Strongly disagree Somewhat disagree Neutral Somewhat agree Strongly agree

This experience helped me learn and discover things I didn't know about disasters.

- Strongly disagree Somewhat disagree Neutral Somewhat agree Strongly agree

Other comments or feedback:

.....
.....
.....

APPENDIX #3 – KIT V2

Hi there! It's nice to meet you!
My name is Kit.

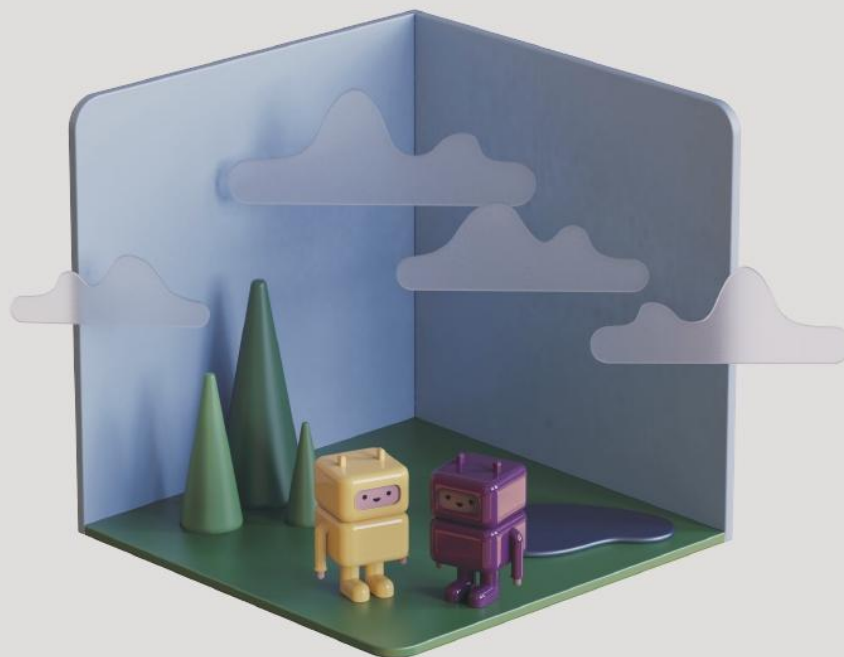
I'm inviting you to go on an adventure with me! There are going to be lots of fun and exploration. So, if you're interested, let's get started!

What do you say we get to know each other a little better?

Let's see... Ok! I'll go first!

I'm a cat person, I like reading and painting. I usually hang out at home and go to the park for walks with my friends.

Actually, I really like the park, it makes me happy whenever I go there. Mostly because I get to spend time with my friend. Here's a picture we took last time we went to the park.



1

How about you? Tell me about yourself!

Actually, to get to know you even better, let's do something else!

To let me know about yourself, you can tell me about your typical day. Maybe you can start by telling me about the places you usually go to.

It could be any place you hang out at or go to from your bedroom to your livingroom, your neighborhood or anywhere else!

Also, feel free to even attach something interesting you find to the booklet so I get a better feel of what your day has been like! There are more instructions on what to do on the next page.

In the meantime, I'll be here. I have some online classes I need to join!



See you later!

There is a space on the next page where you can write down everything, use the stickers, or even draw a map of the places you go to.

You can use the stickers attached to this page to show where you are and how you feel in each place.

Where you are

How you feel

You can use the location icon stickers to show where you went to throughout the day. You can also write down the name of the places under the location sticker. Feel free to add any more detail if you want!

Feel free to take this booklet with you on the journey in case you want to document anything!

You can use the stickers and tell me about your day here!

Where did you go?

Who did you see or spend time with?

Anything else you would like to mention?



Hi again!
It was really nice to
spend the day with
you!

I feel like we already
know each other so much
better!

Speaking of documenting things and paying more attention to our surroundings, I have another fun activity in mind! It's a role-playing game. You and I could become detectives and go on a mission together!

But, before we get started, I have a couple of questions for you.

What is your definition of disasters?

Have you ever experienced a disaster?

If you have experienced a disaster, what would you do differently in the future?



Alright! back to the detective mission.

On this mission, you should explore your surroundings, observe people around you and look for clues.

You might be asking what kind of clues? Our mission is to find out how prepared you and your family are for disasters.

You can use the booklet to document your findings! You can also interview your family members, relatives or friends!



You can use the template on the next page to document everything.

Let's get started partner!

Interviews

Questions you can ask

How do you define disasters?

How do you define disasters?

How do you define disasters?

Questions you want to add

Exploration for clues

What you found out about disasters.

What you think should be done differently to be more prepared for disasters.

Wow! we have come quite far. It's been really nice getting to know you and playing detective!

I still have another idea for an activity that we could do!

But, if you don't feel like it you can continue tomorrow!



Anyway, here's the activity. Let me show you something, it's in my bedroom somewhere.

I'll quickly go look for it.



Here it is! This is a vintage camera my grandpa gave to me! I don't really know how to take pictures with it but I really like this camera. It reminds me of my grandpa's house and all the good memories.

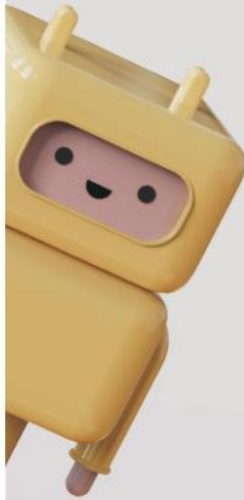
I really want to start learning how to work with it, so I can take nice pictures hopefully someday soon!

What about you? what is an item that's really important to you? wait! don't answer just yet. Take a good look around and let me know what that item is!

Ok! if you have chosen that item, let's go to the next page and talk more about it!

10





So, now I was thinking of a fun challenge! Let's put the item aside for a bit so I can explain.

You know how disasters happen every now and then in different parts of the world! People usually blame it on nature and claim there is nothing us humans can do about it. But, actually! A lot of disasters happen because of mistakes people made in the past. That means there actually are many things we can do about it to keep more people safe from disasters and build a better future!

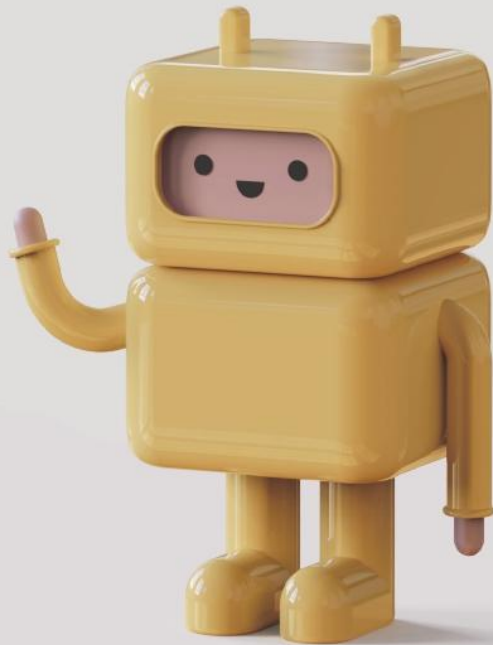
In the next part, let's revisit the item you chose in the last part! Imagine in the future, let's say 5 years from now, how would the item look like? would you still have it? how do you think disasters would affect the future?

Again, you can use the other piece of clay, writing, or drawing to tell a story of what you think will happen in the future and how the future would affect the item you chose?

You can use the space below to draw or write.

It's been really nice hanging out with you! Thanks for
taking me along this journey with you.
I'm so glad I have found a friend like you!

See you later!



APPENDIX #4 – KIT V3





Kia ora, my name is Kit. It's so nice to meet you!

I'm inviting you to go on an adventure with me! There is going to be lots of fun and exploration. So, if you're interested, let's get started!

you say we get to know each-other a little better?

Let's see... OK, I'll go first!

I'm a cat person, I like reading and painting. I usually hang out at home and go to the park for walks with my friends or even visit my favourite ice cream shop.



How about you? Tell me about yourself! What do you like to do in your free time?

Awesome! I feel like I know you better already!

How about we play a little game? It's called 'two truths and a lie'. I say 3 things, 2 of them are true and one isn't. Let's see if you can guess which one is not true!



Most fish live in the sea.

Disasters are natural events.

The sun rises in the East.

Which one do you think is not true?

You can look at the diagram attached to this page and find some hints!

What did you find out about how disasters happen?

Great! Now that we know a little more about how disasters happen, let's do some more fun activities and games!

There are four activities to complete. There is an overview of the activities on the next page if you want to take a look before getting started!



While you have a look through activities, I'll quickly join an online class and then catch up with you later.

1

Diary

2

Detective
role-playing
game

3

Disaster
board game

4

Storytelling,
through
drawing and
clay creations

You can get started with the activities in the order 1 through 4 but if you want to take a break, you can always come back later.

1.Diary

In this activity, you can take the booklet with you through the day and mark the places you visit, the people you meet and how you feel! You can also add stickers or add your own drawings.

Pages 5 to 7

2.Detective Role-Playing Game

In this game, you play the role of a detective, look for clues, interview people and ask your friends or family members about their experience with disasters and find out ways we can all be better prepared for disasters.

Pages 8 to 10

3.Disaster Board Game

In this game, you create a replica of your surroundings and also create a paper version of me and I get a chance to explore your world and we can think about how we can save each other and loved ones in time of a disaster!

Pages 11 to 15

4.Storytelling and Future Thinking

In this activity, you create your most loved object using clay, then answer a few questions about it. You also think about the future and tell me how you see the future using storyboards and storytelling!

Pages 16 to 21

Diary

Let's get started with your diary! You can use the next page to document where you go, who you meet, etc. Use the stickers to write down the name of places and show how you felt when you were there. While you're exploring your surroundings and documenting things, can you identify any disaster risks? If you do, write those down as well!

Here's an example of my diary of a typical day:

Home
When I woke up I went to the kitchen to have some breakfast and I felt happy because breakfast is my favourite meal!

School
I also enjoyed school today. I did well in a quiz and also got to hang out with friends.

Outdoors
After school, I went to the park on my way home but I felt really tired.

Other
After school, I went to my painting class. It was great!

Other
Grandma invited us for dinner and I had a good time! I told her about my new school project but then felt very sleepy.

Home
I finally got back home and it's time for bed. I tried to look for disaster risks. I think one disaster risk is the houses being too close to the sea.

Diary

Date: / /

Home



School



Outdoors



Other



Other



Home



Diary

Hi again!

It was really nice to spend the day with you! and explore your world and finding potential risks that we can be more aware of!



Now if you're ready let's go to the next activity!

Detective Role-Playing Game

What are three words that you associate with disasters?

.....
.....

If you or your family ever experienced a disaster, what happened?

.....
.....

In this part you get to play the role of a detective and go on a mission!

On this mission, you should explore your surroundings, observe people around you and look for clues.

You might be asking what kind of clues? Our mission is to find out disaster risks and how prepared you and your family are for disasters. And what we can do to become even more prepared!



You can use the booklet to write your findings! You can also interview your family members, relatives or friends! There is a template on the next page to document everything.

Let's get started partner!

Detective
Role-Playing
Game



Interviewee:

Questions you can ask

1. What are disasters? -----

2. Have you ever been in a disaster? -----

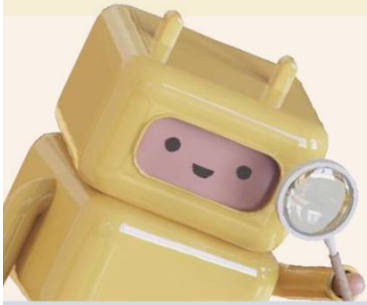
3. What can we do to protect each-other from disasters? -----

4. What could possibly trigger disasters in this area? -----

5. Who do you think will be most impacted if a disaster happens? -----

Use this space to quickly write down notes, clues, or even add drawings of things you found out

Large empty rectangular area for writing notes or drawings.



Detective
Role-Playing
Game

What are the risks in your daily activities if a disaster happens?

Handwriting practice area with six horizontal dashed lines for writing.

How could you reduce those risks?

Handwriting practice area with six horizontal dashed lines for writing.

Great work detective! Now if you're ready, let's move on to the next activity.

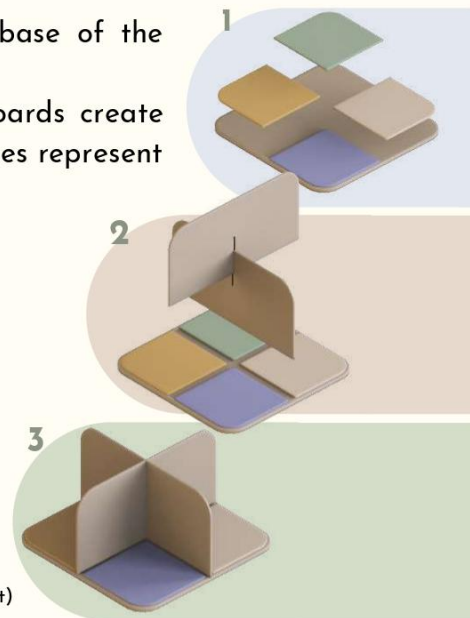
Disaster Board Game

Let's get started with the game. First things first, let's gather all the things you will need for the game from the box. This activity has a lot of pieces but is actually very simple and fun! Just follow the steps and start playing!

You'll find the pieces to create the base of the game in these 3 steps. You'll also see that the assembled boards create four different spaces. Each of the spaces represent a place in your world.



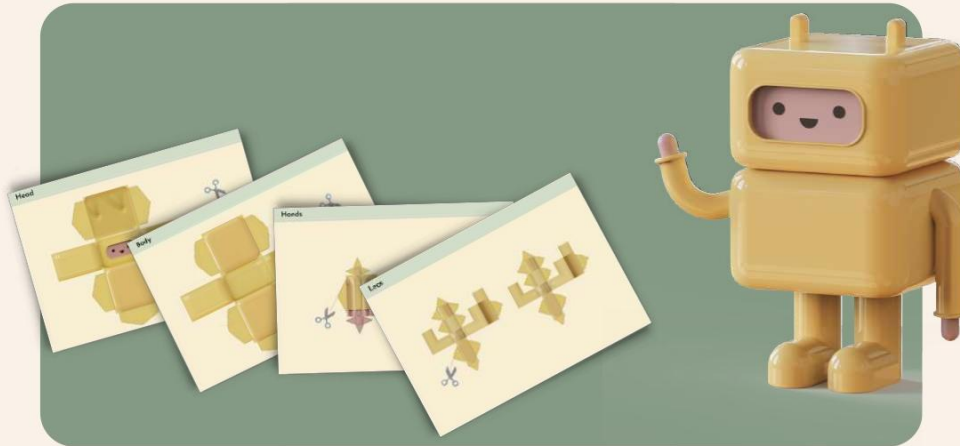
-  Your home
-  Your School
-  Outdoors
-  Custom
(you can choose any place you want)



Once you have the base, you can use the clay from the box (Clay 1) to create different objects for each of the spaces and decorate them! Like a sofa, cars, trees, ...

Disaster Board Game

Next up, you'll find some print-outs in the box that you can use to create a 3D version of me. Just cut and glue the pieces together and you'll be done! That way, I can explore and see the spaces you created and get to know you even better!



Great! Now that you have shown me around maybe you could even take some photos of the spaces you have created and upload them to this QR code, so I can also get to keep these memories!

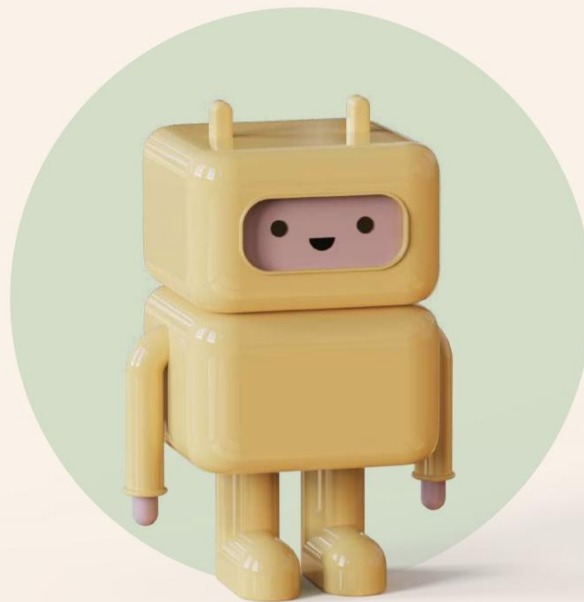


Disaster Board Game

Alrighty! and here's how the game begins. In the box you'll find a dice that has names of different hazards on it. Let's go through each of the spaces together and roll the dice. Your role here is to make the best decisions to save the day and prevent the hazards from causing a disaster!

The next pages have spaces for you to write your answers!

Once you're done with your answers, I'll see you in the next activity. And don't forget! If you don't feel like you can take a break or come back the next day!



Disaster Board Game

Starting at home! let's roll the dice...

What was the hazard according to the dice?

What would be your first action in this situation?

Who would be there with you?

Who would you contact?

How would you save Kit?

Next, let's go to school and roll the dice...

What was the hazard according to the dice?

What would be your first action in this situation?

Who would be there with you?

Who would you contact?

How would you save Kit?

Disaster Board Game

Next, let's go to the outdoors and roll the dice...

What was the hazard according to the dice?

What would be your first action in this situation?

Who would be there with you?

Who would you contact?

How would you save Kit?

Next, let's go to the _____ and roll the dice...

What was the hazard according to the dice?

What would be your first action in this situation?

Who would be there with you?

Who would you contact?

How would you save Kit?

Storytelling
and Future
Thinking

Welcome to the final activity! Here, I want to get to know you even better. But before we get started, let me show you something! It's an item I love the most. Should be in my bedroom somewhere. I'll quickly look for it!

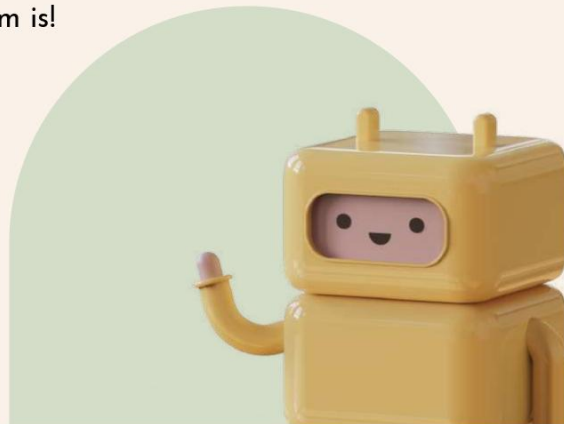


Storytelling
and Future
Thinking



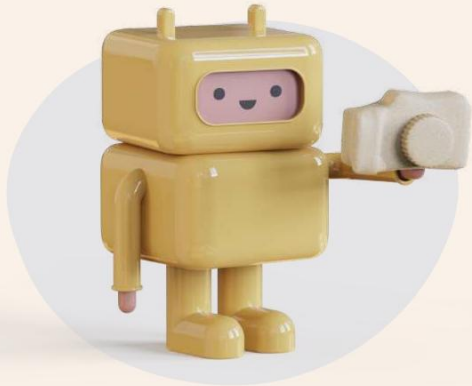
Here it is! This is a vintage camera my grandpa gave to me! I don't really know how to take pictures with it but I really like this camera. It reminds me of my grandpa's house and all the good memories. I really want to start learning how to work with it, so I can take nice pictures hopefully someday soon!

What about you? what is an item that's really important to you? wait! don't answer just yet. Take a good look around and then let me know what that item is!



Storytelling
and Future
Thinking

Great! Now to let me know what this item looks like, you can either use the clay (Clay 2) from the box to make a replica of it so that I can know what it looks like!



Once you're done with your clay creation, just leave it to dry for 24 hours and then put it back in the box so I can look at it later. Here's what I made with clay. It's the camera!

Use the space below to describe the item you have chosen.

It is a(n) _____ .

I got it from _____ .

It used to be _____ when I first got it.

It reminds me of _____ .

When I see it, I feel _____ .

_____ caused it to change.

The change means _____ to me.

I hope it _____ in the future.

Storytelling
and Future
Thinking

In the next part, let's revisit the item you chose in the last part! Imagine in the future, let's say 6 years from now...

Would you still have it in 6 years from now? _____

What do you think the item would look like in 6 years from now? _____

Why do you think the item would be that way in the future? _____

Do you think disasters will have an impact on the item? _____

You know how disasters happen every now and then in different parts of the world! People usually blame it on nature and claim there is nothing us humans can do about it. But, actually! A lot of disasters happen because of mistakes people made in the past. That means there actually are many things we can do about it to keep more people safe from disasters and build a better future!

Speaking of the future, what do you think a typical day for you would be like in 6 years from now?

On the next page you can create your 'future' diary!



Storytelling
and Future
Thinking

It's the year 2028, and you're writing in your diary on a typical day. Where would you go? who would you meet?



Home

School

Outdoors

Other

Other

Home

Storytelling
and Future
Thinking



Now that you have been thinking about the future, what do you think are the disaster risks in the future?

What do you think we can do now to prevent future risks?

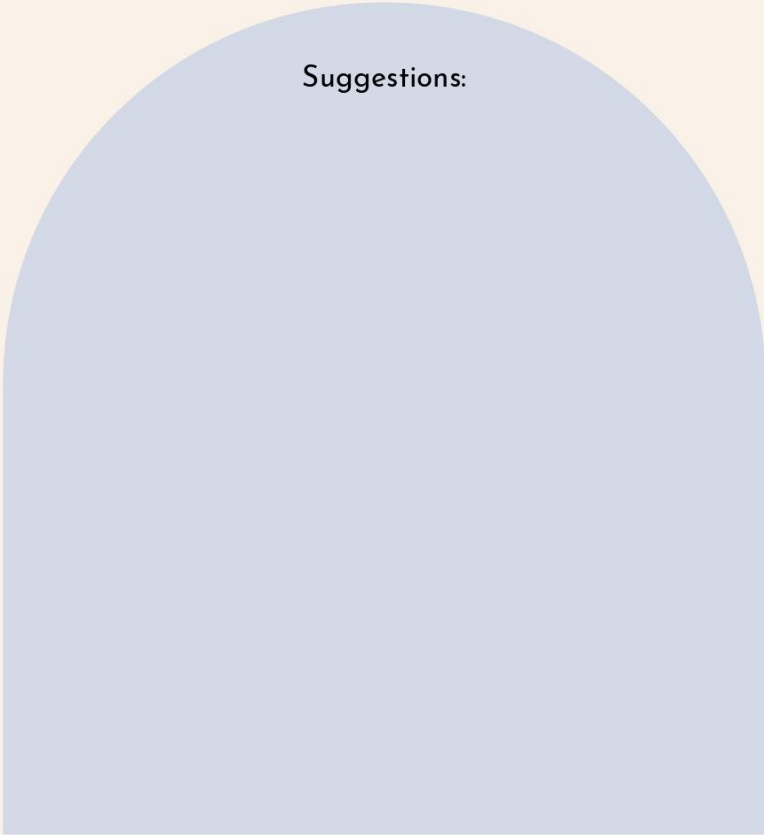
Awesome job!
Thank for hanging out with me. I'm so glad I have
found a friend like you!
Don't forget to collect your gift!

Finally, I only have a question for you. Not really a question even. I just wanted to ask for your suggestions. Did you enjoy this experience? Do you have any suggestions to improve these activities?

If you do have suggestions, leave them in the space below and I will read them later.

Thanks!

Suggestions:



Now that you have completed all the activities, here is how you can return the booklet to Mojan, the researcher of this study who is also friends with Kit!

All you need to do is:

1. Put the booklet in the box (make sure to include the attached paper too)
2. Make sure you have uploaded your pictures of the board game to the QR code.
3. Put the clay creation of your favourite item that you made in the box (You can keep the board game items and your clay decorations to play again whenever you want).
4. Find the plastic bag in the box and put the box in the plastic bag.
5. Contact Mojan to let her know you have completed the activities and arrange a time to leave the box at your mailbox and ask Mojan to collect it.

You can contact Mojan by sending her an email at: mojan.mosavat@autuni.ac.nz

or give her a call or send her a text at:
02108026445



APPENDIX #5 – KIT V4: FINAL VERSION





Kia ora, my name is Kit. It's so nice to meet you!

I'm inviting you to go on an adventure with me! There is going to be lots of fun and exploration. So, if you're interested, let's get started!

What do you say we get to know each-other a little better?

Let's see... OK, I'll go first!

I'm a cat person, I like reading and painting. I usually hang out at home and go to the park for walks with my friends or even visit my favourite ice cream shop.

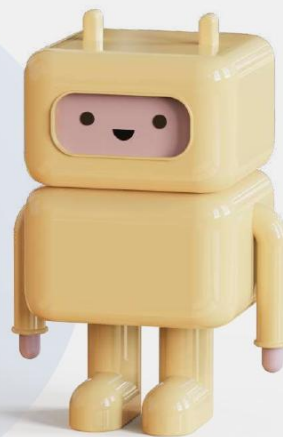


How about you? Tell me about yourself! What do you like to do in your free time?

Awesome! I feel like I know you better already!

How about we play a little game? It's called 'two truths and a lie'. I say 3 things, 2 of them are true and one isn't. Let's see if you can guess which one is not true!

Put a ✓ in front of the true sentence and a ✗ in front of the false sentence.



Most fish live in the sea.

Disasters are natural events.

The sun rises in the East.

Check out the diagram attached to this page to find a hint!

What did you learn about how disasters happen?

Who do you think is responsible for disasters?

Who do you think is most affected by disasters?

Great! Now that we know a little more about how disasters happen, let's do some more fun activities and games!

There are four activities to complete. There is an overview of the activities on the next page if you want to take a look before getting started!



While you have a look through activities, I'll quickly join an online class and then catch up with you later.



You can get started with the activities in the order 1 through 4 but if you want to take a break, you can always come back later.

1.Diary

In this activity, you can take the booklet with you through the day and mark the places you visit, the people you meet and how you feel! You can also add stickers or add your own drawings.

2.Detective Role-Playing Game

In this game, you play the role of a detective, look for clues, interview people and ask your friends or family members about their experience with disasters and find out ways we can all be better prepared for disasters.

3.Disaster Board Game

In this game, you create a replica of your surroundings and also create a paper version of me and I get a chance to explore your world and we can think about how we can save each other and loved ones in time of a disaster!

4.Time Capsule

In this activity, you create your most loved object using clay, then answer a few questions about it. You also think about the future and tell me how you see the future using storyboards and storytelling!

Let's get started with your diary! You can use the next page to document where you go, who you meet, etc. Use the stickers to write down the name of places and show how you felt when you were there. While you're exploring your surroundings and documenting things, can you identify any disaster risks? If you do, write those down as well! Here's an example of my diary of a typical day:

<p>HOME</p> <p></p> <p>When I woke up I went to the kitchen to have some breakfast and I felt happy because breakfast is my favourite meal!</p> 	<p>SCHOOL</p>  <p></p> <p>I also enjoyed school today. I did well in a quiz and also got to hang out with friends.</p>
<p>OUTDOORS</p>  <p></p> <p>After school, I went to the park on my way home but I felt really tired.</p>	<p>OTHER</p> <p></p> <p>After school, I went to my painting class. It was great! The building is very old and can be dangerous in time of a disaster.</p>
<p>OTHER</p> <p></p> <p>Grandma invited us for dinner and I had a good time! I told her about my new school project but then felt very sleepy.</p>	<p>HOME</p> <p></p> <p>I finally got back home and it's time for bed. I tried to look for disaster risks. I think one disaster risk is the houses being too close to the sea. That's something to look out for.</p> 

Date: / /

HOME

SCHOOL

OUTDOOR

OTHER

OTHER

HOME

Hi again!

It was really nice to spend the day with you! and explore your world and finding potential risks that we can be more aware of!



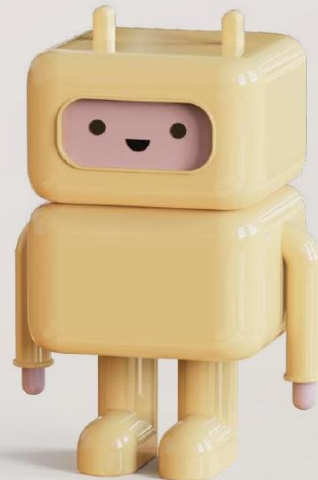
Now if you're ready let's go to the next activity!

What are three words that you associate with disasters?

If you or your family ever experienced a disaster, what happened?

In this part you get to play the role of a detective and go on a mission! On this mission, you should explore your surroundings, observe people around you and look for clues.

You might be asking what kind of clues? Our mission is to find out disaster risks and how prepared you and your family are for disasters. And what we can do to become even more prepared!



You might be asking what kind of clues? Our mission is to find out disaster risks and how prepared you and your family are for disasters. And what we can do to become even more prepared!



Interviewee:

Questions you can ask

1. What are disasters?

2. Have you ever been in a disaster?

3. What can we do to protect each-other from disasters?

4. What could possibly trigger disasters in this area?

5. Who do you think will be most impacted if a disaster happens?

Use this space to quickly write down notes, clues, or even add drawings of things you found out

Large empty rounded rectangular box for notes and drawings.

Great job on the interview! you are a pro! now, let's see if we can find some clues. What do you think in your surroundings can be a risk in time of a disaster? What can you identify that can bring damage in case of a disaster? And how can we be more prepared for these things?

Next time you are going out or to school, bring the booklet with you and write down all the risks you can find.

Let's see how many you can find. Don't forget a good detective has a good eye and pays attention to every detail.



Risk clues:

Time and Place:

Your solution:



Risk clues:

Time and Place:

[Empty box for notes]

Your solution:

Time and Place:

[Empty box for notes]

Your solution:



Great Job detective! Now that you have done all this detective work, what have you learned? What was the most important risk clue you found?



Awesome! It's definitely important to always be aware of the risks in the surroundings and to always have a plan on what to do in time of a disaster to help ourselves and others around us!

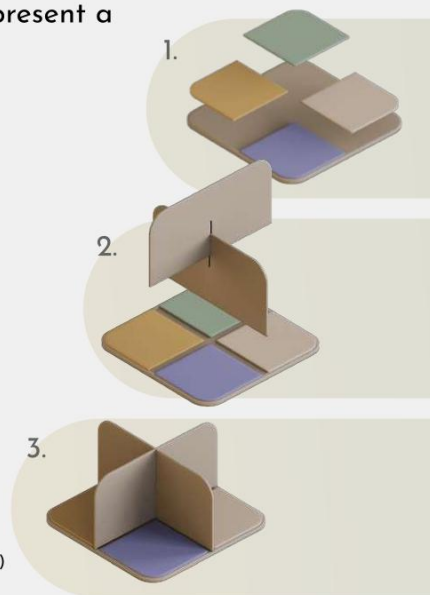
Let's get started with the game. First things first, let's gather all the things you will need for the game from the box. This activity has a lot of pieces but is actually very simple and fun! Just follow the steps and start playing!

You'll find the pieces to create the base of the game in these 3 steps.

You'll also see that the assembled boards create four different spaces. Each of the spaces represent a place in your world.

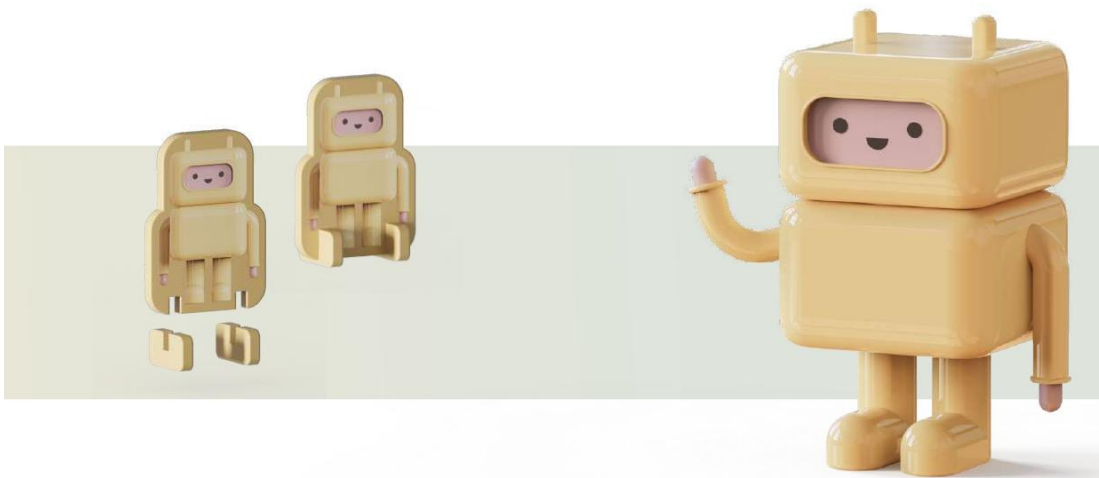


-  Your home
-  Your school
-  Outdoors
-  Custom
(you can choose any place you want)

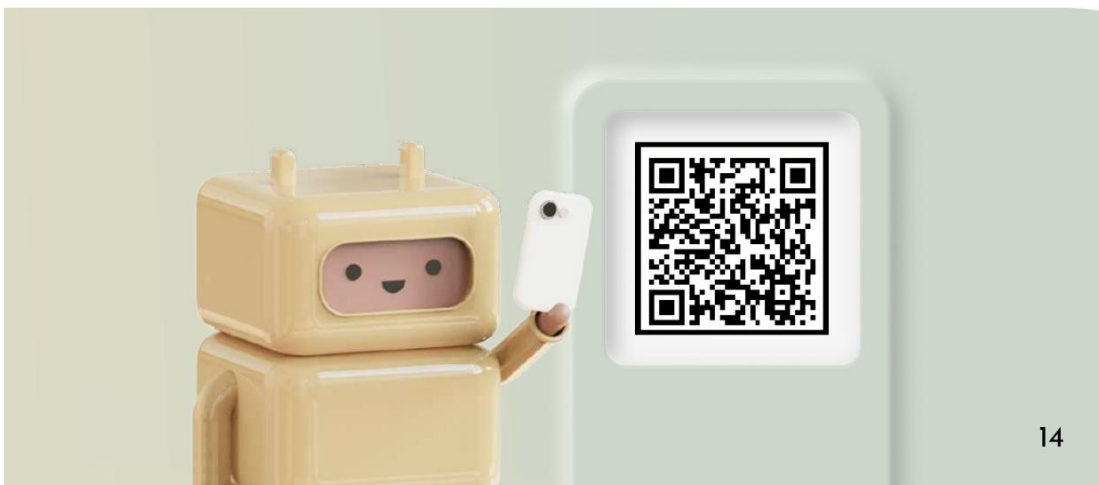


Once you have the base, you can use the clay from the box to create different objects for each of the spaces and decorate them! Like a sofa, cars, trees, or whatever you like!

Next up, you'll find an avatar of me in the box that you can assemble together and you'll be done! That way, you can bring me into your world and show me around so I can explore and see the spaces you created and get to know you even better!



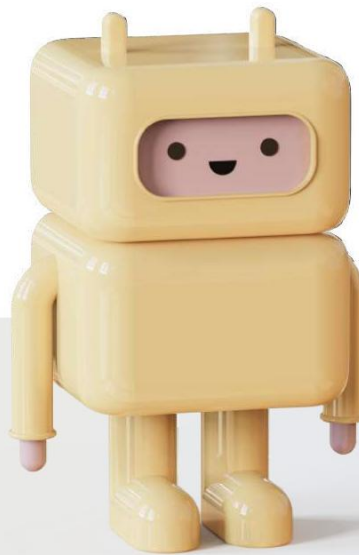
Great! Now that you have shown me around maybe you could even take some photos of the spaces you have created and upload them to this QR code, so I can also get to keep these memories!



Alrighty! and here's how the game begins. In the box you'll find a dice that has names of different hazards on it. Let's go through each of the spaces together and roll the dice. Your role here is to make the best decisions to save the day and prevent the hazards from causing a disaster!

The next pages have spaces for you to write your answers!

Once you're done with your answers, I'll see you in the next activity. And don't forget! If you don't feel like you can take a break or come back the next day!



Starting at home! let's roll the dice...

What was the hazard according to the dice?

What would be your first action in this situation?

Who would be there with you?

Who would you contact?

How would you save Kit?

Next, let's go to school and roll the dice...

What was the hazard according to the dice?

What would be your first action in this situation?

Who would be there with you?

Who would you contact?

How would you save Kit?

Next, let's go to the outdoors and roll the dice...

What was the hazard according to the dice?

What would be your first action in this situation?

Who would be there with you?

Who would you contact?

How would you save Kit?

Next, let's go to the ----- and roll the dice...

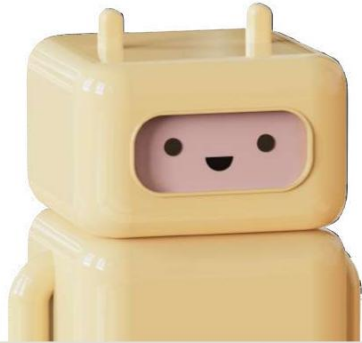
What was the hazard according to the dice?

What would be your first action in this situation?

Who would be there with you?

Who would you contact?

How would you save Kit?



Awesome job finishing that activity! Now, think about this:
What amazing ideas did you come up with to get extra
prepared for emergencies? What are the most important
lessons you picked up? I'm excited to hear your thoughts!

A large rectangular area with a light blue background and a rounded border, containing ten horizontal dashed lines for writing.

Hi again! Welcome to the final activity.
Do you know what's a time capsule? We're going to
make one! It's like a message for the future.
Don't worry if you're not quite sure how this works
yet. I'm going to show you!

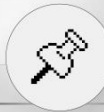


A time capsule can be some
kind of container filled with
items that you can burry or
hide away.

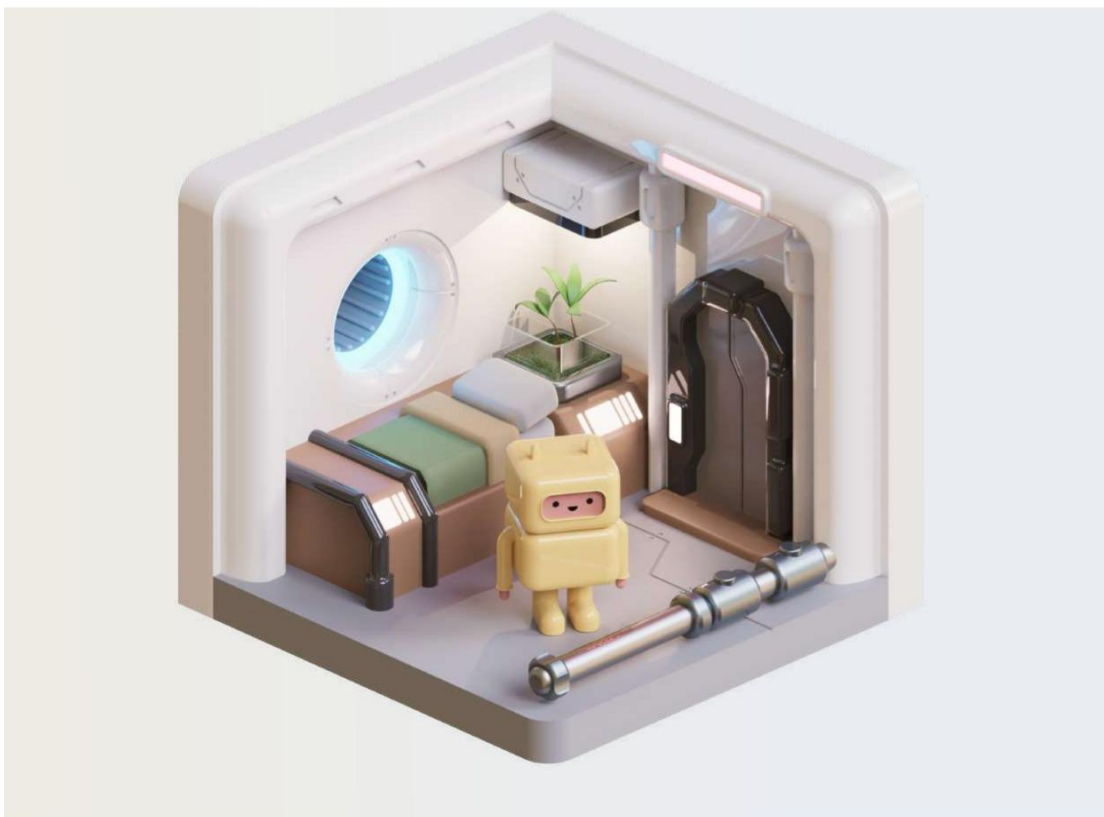


People from the future can
study and get a snapshot of
life at a particular time.

This way you can include
different things and
documents to send a
message to the future!



Welcome to the future! Let's imagine it's the year 2044. I think by then my bedroom would look something like this picture. Every time I think about the future, I visualise something cool and futuristic!



What do you think the future will look like? On the following pages, you can find the time capsule template to write down your answers and complete your time capsule!



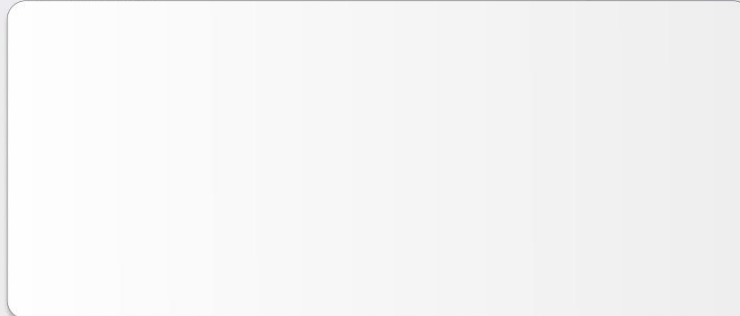
Hi again! Meet Kit from the future
It's the year 2044! Let's see what are your
thoughts and ideas about the future and
add them to the time capsule.

Let's start with some drawings in the boxes below:

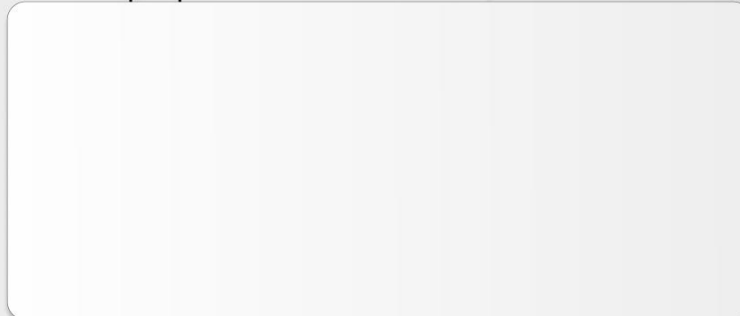
What do you think your room will
look like in the future?

What do you think your city will
look like in the future?

What disaster risks do you think will be there in the future?



How do you think disasters will affect the future? and the people in the future?



Now let's think about some of the things that we can leave in the capsule for people in the future to help them be better equipped and prepared for disasters.

Follow the next page to see the questions. Don't forget you can also discuss these questions with family members and add what they think as well!

What tools and resources do you think can help people with disasters in the future?

What problems would you report to the people in the future to be aware of?

What do you think we can do to have a world without disasters?

And finally, what is one key message you would leave for people in the future?



Awesome job!
Thank you for hanging out with me. I'm so glad I have found a friend
like you! I also learned a lot from you and you inspired me to keep
learning even more about disaster preparedness

Don't forget to collect your gift from the box!

I'd better go do my homework now, take care!



Now that you have completed all the activities, here is how you can return the booklet to Mojan, the researcher of this study who is also friends with Kit!

All you need to do is:

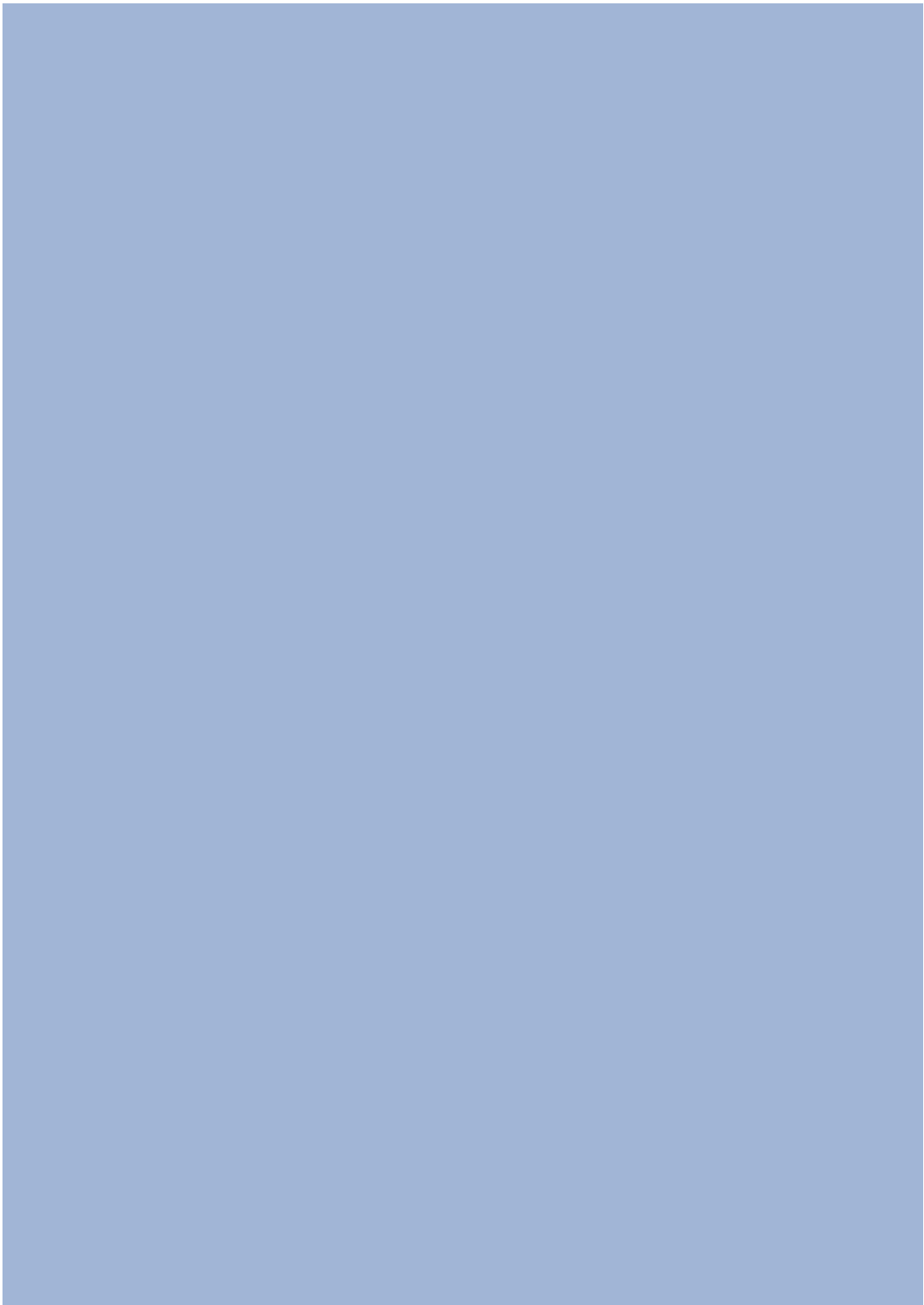
1. Put the booklet in the box (make sure to include the attached paper too)
2. Make sure you have uploaded your pictures of the board game to the QR code. You can keep the clay creations and the board game for yourself. And don't forget to collect your gift!
3. Find the plastic bag in the box and put the box in the plastic bag.
4. Contact Mojan to let her know you have completed the activities and arrange a time to leave the box at your mailbox and ask Mojan to collect it.

You can contact Mojan by sending her an email at:
mojan.mosavat@autuni.ac.nz

or give her a call or send her a text at:

02108026445





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hl=en&lr=&id=LcMLnuxftHsC&oi=fnd&pg=PA185&dq=gaver+probes&ots=pHYk4REM-x&sig=loFliXNRLRNaY00

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