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Fostering Children's Participation in Disaster Risk Reduction Through Play: A Case Study of LEGO and Minecraft

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Abstract This article focuses on children's participation in disaster risk reduction. It draws on a 2018 study done in New Zealand with 33 school children who conducted participatory mapping with LEGO and the video game Minecraft to assess disaster risk in their locality and identify ways to be more prepared. The research involved participatory activities with the children actively involved in the co-design, implementation, and evaluation of the initiative. A focus group discussion was also conducted to assess the project from the viewpoint of the schoolteachers. The results indicate that LEGO and Minecraft are playful tools for children to participate in disaster risk reduction. The research identifies four key elements of genuine children's participation, including the Participants, Play, the Process, and Power (4 Ps). This framework emphasizes that fostering children's participation in disaster risk reduction requires focusing on the process through which children gain power to influence decisions that matter to them. The process, through play, is child-centered and fosters ownership. The article concludes that Play is essential to ground participation within children's worldviews and their networks of friends and relatives.

Keywords Children's participation · Disaster risk reduction · New Zealand · Participatory game tools

1 Introduction

Over the last few decades, academics, practitioners, and policymakers have advocated for children's and youths' participation in the development aspects of the society they live in (Hart 1992). Participation is a voluntary process by which people—including those disadvantaged, marginalized, and/or excluded from mainstream debates and actions—can shape or control the decisions that affect them (Saxena 1998). The United Nations Convention of the Rights of the Child (CRC) adopted in 1989 points out the need to enhance children's participation in public policy and development. Article 12 of the Convention states that, if children are capable to express their own viewpoints, it is crucial for adults to create a space for them to do so.

In recent years numerous initiatives have emerged to foster children's participation in various subfields of development such as poverty alleviation, urban planning, environmental management, climate change adaptation, and disaster risk reduction (DRR). These initiatives have focused on identifying children's knowledge and capacities as agents of change (Bartlett 2002; Mitchell et al. 2009), documenting good practices to foster children's participation (Willow 2002; Sinclair 2004), classifying different levels of participation (Shier 2001; Noreau et al. 2007; Mayne et al. 2018), as well as developing participatory tools and tool kits targeting children (Lansdown and O'Kane 2014).

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¹ Throughout this article the term children is used to refer to both children and youths

This burgeoning literature has in common the recognition that children have both the agency and right to participate on matters that affect their lives, including DRR (Mitchell et al. 2009; Lopez et al. 2012). Children represent a considerable proportion of those who are impacted by disasters (UNDRR 2020). It is estimated that each year 175 million children around the world are affected (Save the Children 2014). Studies show that children's participation in DRR can increase their disaster preparedness, lead to more robust and sustainable solutions for both children and society, and empower them for future DRR actions (Lansdown 1995; Sinclair 2004; Pfefferbaum et al. 2018).

Genuine participation means that the participatory process should be child-centered as in the emerging practice of child-centered DRR (CCDRR) (Hore et al. 2018). Child-centered DRR emphasizes that children, in all their diversity, shall play a central role in every phase of a given initiative including its design, production of information, its analysis, and the definition of solutions and their monitoring in the long term. In this view, children should be empowered to identify actions that address their concerns and priorities, and to conduct future actions towards reducing the risk of disaster (Mitchell et al. 2009). Despite different calls for increased children's participation in DRR, children's voices still tend to be ignored when important decisions are made (Sinclair 2004; Crowley 2015) and CCDRR generally occurs in name, not in practice (Delicado 2017).

In recent years, technology has made an incursion into the field of participatory initiatives geared towards DRR. For example, mobile phones and tablets now allow people to collect and immediately share a wide range of local data with various stakeholders of DRR. These technological devices are increasingly designed to be user-friendly, often in the form of games and playful activities, thus providing a large array of opportunities to foster children's participation (Granic et al. 2014; Gampell and Gaillard 2016; Peek et al. 2016; Toyoda 2016; Gampell et al. 2020). In the last five to 10 years video games—such as Stop Disasters!, Earthgirl 2, and Sai-Fah: The Flood Fighter—have been developed to engage children in DRR (Gampell et al. 2020). LEGO and robotics such as LEGO® Technic and Mindstorms are other examples of how technological devices coupled with play could enable children to participate in disaster preparedness and development in a fun and creative way (El Sawy et al. 2016; Afari and Khine 2017). However, there does not seem to be much reflection on the capacity of such technological advancement and the multiplication of games, to effectively encourage the participation of children in DRR and foster disaster preparedness (Gampell and Gaillard 2016).

This article draws on a case study from New Zealand where LEGO and the video game Minecraft were used to

foster children's participation in DRR. LEGO is the biggest toymaker in the world and is a popular symbol of childhood in many cultures, while Minecraft is one of the most-played video games today. Both tools can be used by anyone, including children with learning difficulties and dyslexia. LEGO and Minecraft provide the opportunity to explore children's participation with physical and digital games. Our project's goals were to: (1) pioneer participatory initiatives with children using Minecraft and LEGO; (2) assess the outcomes of these initiatives; and (3) identify the key elements that led to genuine or problematic participation.

2 Methodological Approach and Tools

The research adopted a participatory approach so children could play a central role in both the DRR process and its outcomes. This methodological approach draws from Participatory Learning and Action, which Chambers (2002, p. 3) defines as “a growing family of approaches, methods, attitudes and behaviours to enable and empower people to share, analyse and enhance their knowledge of life and conditions and to plan, act, monitor, evaluate and reflect.” Participatory Learning and Action is a widespread approach to participatory development that embodies the ethos of CCDRR as a process to balance power relations between the children and the adults. The methodological tools used in this study fostered children's participation in the co-design, implementation, and evaluation of the initiative.

2.1 Research Project

The project took place in the small village of Maraekakaho near the Maraekakaho and Ngaruroro Rivers in the Hawke's Bay region on the east coast of New Zealand's North Island. The area is exposed to a wide range of hazards. In 2007, the village was flooded, which resulted in the evacuation of the local school. Bush fires occur regularly, earthquakes are a real threat, and the local people are isolated with limited to no cell-phone coverage. In 2017, the local people approached their council to develop a disaster resilience plan so that people could better prepare in the face of hazards. The local people and emergency management staff from the council proposed involving the school. The local school was very interested, and the timing matched with a module of their curriculum on disasters. The researchers met with the school principal and teachers while in parallel the teachers discussed the initiative with their students.

Following several meetings, it was decided that technology and games could be utilized as ways to foster participation and increase disaster preparedness. The researchers proposed using 3-dimensional (3D) participatory mapping with both LEGO and a video game to map out the local school and its surroundings. Participatory mapping has emerged as an effective approach to foster children's participation in DRR (Chambers 2009). Maps provide opportunities to involve children, local people, and practitioners in planning and disaster preparedness. LEGO is very popular among children and adults/parents often play LEGO with their children. The game is popular in New Zealand and provides opportunities for creativity and group collaboration. The choice of using Minecraft was the product of a collective decision after screening different video game options (that is, LEGO Worlds). Video games are used increasingly in disaster studies (Gampell and Gaillard 2016), with Minecraft being played by both children and adults, thus potentially enabling dialogue about DRR. Furthermore, both the teachers and students proposed using robotic, 3D printing, and filming so it would fit with the themes of technology, participation, and DRR. Research ethics approval was obtained from the lead researcher's university with number 17/263.

2.2 Methods

A total of 90 students aged 8–13 years participated in the initiative. The first session involved an expectation check that was aimed at defining what the children wanted to achieve in the project and what could make this a success. It was essential for the children to identify their goals, priorities, and take ownership of the project. The following group activities were focused on collectively identifying aspects linked to hazards and disaster risk surrounding the school and the village. After two weeks, the children decided which project group they wanted to be part of. Children could change group at any time. A total of 13 children, aged 10–12 years, chose LEGO and 20 children, aged 8–13 years, chose Minecraft. The other children decided to join the robotic, 3D printing, and filming groups which is beyond the scope of this study.

Participatory LEGO and Minecraft mapping were conducted between February and September 2018. The children playing with Minecraft or LEGO were involved in 16 sessions that lasted one and a half hours each and were composed of participatory tools often used in DRR, including carousel, transect walk, ranking, scoring, and mapping. These tools are grouped under the umbrella of Participatory Learning and Action commonly used in participatory development and DRR.

The overall process was divided into four main stages across the 16 sessions. The first stage was about identifying

the disaster risk for the school and broader community. It involved different tools such as a carousel and scoring and ranking to identify and prioritize hazards, vulnerability, and capacities. The second phase was about building the base map in three dimensions. Having three dimensions enabled, for example, identifying high ground areas for evacuation should a flood happen. For Minecraft, the researchers developed a georeferenced Minecraft world that provided the students with an initial spatial structure. This base layer included building outlines, elevations, and other geographical features and characteristics including roads and rivers. All geospatial input data were freely available from Land Information New Zealand with no usage restrictions so this could very easily be replicated at no cost in any school. The rationale for including the base layer was to ensure that the children would have a base to start mapping while at the same time making sure there were as few features as possible on the "Minecraft world" so they could take ownership of the map and lead the process. For LEGO, a digital map of the local community with contours (elevation) was obtained from the local council for free and then printed on paper at the local print shop. The third phase involved the children deciding which information to map in their Minecraft world and with LEGO bricks and then plot this information. The last phase was about using the final maps for DRR planning and preparedness, including with adults.

While this provided an overall structure for the participatory process, it was critical for the children, teachers, and researchers to collectively design each session (Fig. 1). It was decided that the researchers, who had experience with

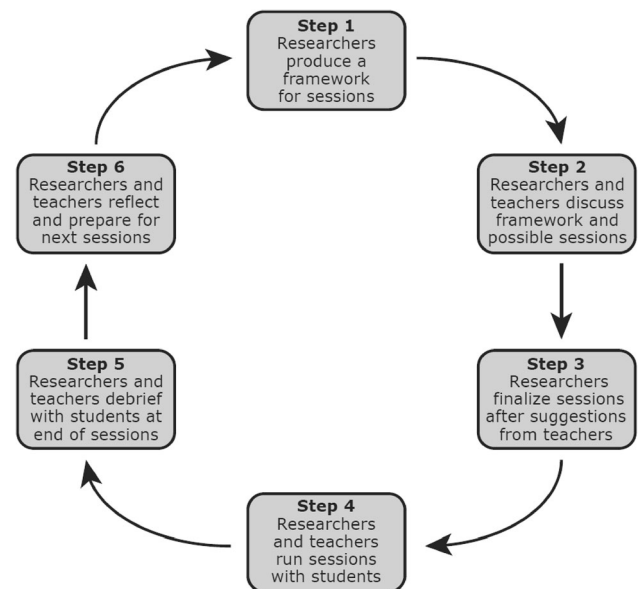


Fig. 1 Co-design process involving children, teachers, and researchers of the disaster risk reduction participatory mapping project, New Zealand 2018

participatory tools, would provide a framework for the participatory sessions. These were purposefully loose rather than a rigid blueprint so children and teachers could modify them. It is also essential to emphasize that the researchers had never used LEGO or video games for participatory mapping (this had to our knowledge never been done), so they were learning with the children and teachers during the process. The teachers' involvement in designing the sessions was essential to make sure the content would be in line with the curriculum, anticipate difficulties, and identify opportunities for genuine participation, as ultimately, they knew their students best. The children played an essential role in the design of the activities by providing feedback, advice, and recommendations during and after each session to identify the best approach for the following sessions. This was done through group conversations at the end of each activity. Based on the children's feedback, the content, format, or time frame of the sessions would be modified. The children were leading the mapping process including deciding what to map, how to map, the map's utilization, solving problems together, and so on. The role of the researchers, who were co-facilitating with teachers, was to ensure that the process was continuously evolving and to provide an equitable platform for open dialogue within the group.

Every session was documented by the researchers who were taking notes on both the participatory process and the debrief discussions with the children. At the end of the project, two focus group discussions (FGDs) of one hour each were conducted with the children to assess the overall project. During the FGDs, a Strengths, Wants, Opportunities, and Challenges (SWOC) analysis and participatory ranking method were utilized. These tools are commonly used in development studies and DRR (Gaillard et al. 2016). In addition, one FGD of one hour was conducted with the schoolteachers involved in the co-design and facilitation of the activities. The children's evaluation, teachers' feedback, and researchers'/facilitators' notes were compiled, compared, and thematically analyzed.

3 Results

The results section treats the Minecraft and LEGO parts of the project together since despite slight differences, there were many similarities both with the process and the outcomes.

3.1 Children's Connections with LEGO and Minecraft

LEGO and Minecraft were effective in capturing the students' interest from the start and fostered their active

participation through the entire project. For LEGO, all 13 students reported having previous experience—a key factor of their decision to choose LEGO. For Minecraft, only 3 children did not know how to play the video game, while the other 17 all indicated playing regularly. The students' familiarity with LEGO and Minecraft resulted in a child-led process where they felt comfortable stepping into a leadership role, both with respect to the logistics of the mapping process and the knowledge produced. Jason (aged 12) highlighted:

I worked on the legend and I liked that as I got to make my own choices, like it was my idea to write out the words on the legend using LEGO bricks instead of using paper. I guess I have a lot of LEGO at home so it was easy to work out how to make the best combinations with the bricks.

Both LEGO and Minecraft are rooted in children's everyday life and as a result, the children rapidly became the "experts" as they had more experience than the researchers and teachers even before the project started. The children using Minecraft advised the researchers and teachers and facilitated the activities of different technical trouble shooting strategies to access Minecraft while within the school.

The tools were accessible to all participants of all levels of experience and ability within the groups. LEGO and Minecraft were also effective in engaging female and male participants equally. Notably, for LEGO, the girls participated more at the beginning when the concepts of hazards, vulnerability, and capacities in the community were defined. The boys were more engaged when the construction began. It was the other way around for Minecraft with the boys more enthusiastic and familiar with playing Minecraft at the start. However, very quickly the girls were hands on mapping and discussing DRR using the video game, participating as much as the boys.

The fact that LEGO and Minecraft are visual, interactive, and easy to use independently of any literacy or numeracy skills, made the process accessible to a wide range of age groups. LEGO also enabled children from a wide range of social skills to actively engage in DRR, because it provided a visual display of how they perceived their hazards, vulnerabilities, and capacities at a community level. Minecraft also saw children with learning difficulties actively engage in gameplay and discussions about DRR, as it opened up a pathway for them to demonstrate their knowledge in a format that was familiar and engaging. However, the results indicate that the age range of the group needs to be carefully considered. Children aged 14 years or older might perceive LEGO as "childish" while for 0–4 years of age it might require fine motor skills that have not been developed yet. With respect to Minecraft,

children aged over 11 years might be interested in other video games appropriate to their age. Some of the participants between 11 and 13 years old commented on other games they played more, such as Fortnite or Battle-Royale.

Because LEGO is designed to be put together and pulled apart it also meant students of less experience or of different abilities felt comfortable making mistakes. The same applied to Minecraft where the children could create or undo anything they wanted very easily. This aspect helped encourage the children to take more “risks” and be creative. For example, they could reconstruct a certain area or add new information on the maps such as evacuation points or flood-prone areas. This led to more discussions among themselves, with the children taking ownership of the process, solving problems, and overall discussing intensively their surrounding environment and disaster risk.

3.2 The Power of Play

One of the most important aspects that emerged was the playful dimension of the process and its importance in fostering the children’s participation. This was particularly obvious in the assessment done by the children who emphasized that the main strength of the project was that they “got to play with their friends” (Table 1):

“I like playing with LEGO so I thought this would be fun. Then my favorite thing about being in the LEGO group has just being able to play with my friends and create our community. (Stevie, aged 11)

Being able to build their community while playing with their friends and listening to music were central aspects that helped foster the children’s participation in DRR. The children felt like they were “missing out on schoolwork” while also learning from each other about their community, disasters, and risk reduction. The environment created felt different from the normal classroom setting, where

generally the structure is more formal with a clear hierarchy between the adult (teacher) and the student (child). Tom (aged 11) emphasized:

All of us are very happy playing together because we are all friends. Also, what I have enjoyed over the project is [the facilitator name] being very encouraging to us and lets us move about to another group if we have finished and another group needs help finishing something else.

The students ranked “working with friends” and “being able to play with LEGO/Minecraft which is something we have at home” as the greatest strengths of the entire project. When trying to get the students to prioritize one over the other, they viewed the two strengths of equal importance. This reiterates the complexity of participation and how several aspects of the process (that is, play and the participants) correlate and encourage participation. While play was a critical aspect raised by the children and in line with the researchers’ field notes, the results show that the children also highly valued “working together” as well as the “final outcome” resulting from such collaboration. Lula (aged 11) commented:

My favorite thing so far has just been building LEGO, cause it’s cool looking at the map as it comes together.

The idea of “seeing the final outcome” was continuously brought up throughout the entire project. That is, the playful dimension of the process was essential to the children’s active participation, but they were also motivated by visualizing their work taking shape and “looking great” (Mason, aged 12). With LEGO there was a sense of pride in completing the map and interacting with the adults about their own interpretation of DRR within their community. For Minecraft, the final outcome was not as visually tangible. However, the multiplayer and virtual

Table 1 Strengths of the 2018 disaster risk reduction participatory mapping project in New Zealand as identified by the children and the researchers

Strengths Identified by the Children	Strengths Identified by the Researchers/Facilitators
5 Stickers: “working with friends” and “being able to play with LEGO/Minecraft which is something we have at home”;	All students involved in the process had prior experience with LEGO/Minecraft;
4 Stickers: “being able to build the community with my friends”;	Participants’ experience rapidly made them “experts” while having fun, and they rapidly took ownership of the process;
3 Stickers: “seeing the final outcome” and “missing schoolwork”;	Students of all abilities, skills, and background within the group could actively participate;
2 Stickers: “able to listen to music and work”;	LEGO/Minecraft held their interest and kept them actively engaged throughout the entire process;
1 Sticker: “making our LEGO/Minecraft people.”	Both games were effective in engaging male and female participants.

aspects of Minecraft meant the children could work together within the game world but also see the potential outcomes of different issues like flooding in different areas, resulting in discussions about how such risks could be managed.

3.3 Limitations of the Process

Many of the limitations identified by the students were also limitations that the researchers had identified and documented in the field notes. The students highlighted “not having enough time to make the map look exactly how we wanted it to look” as one of the biggest limitations of the process. To overcome this, the children requested from the school principal to be able to come to the school over the weekend and work together on their LEGO map. While the researchers supported the children's initiative, this was rejected by the school principal for health and safety reasons. The same occurred with Minecraft with the children asking to complete the map during weekends using the devices from home. This was also rejected, the reason being that the parents would not agree. These refusals emphasize the limitations linked to working in a school environment that restricted a genuine participatory process. But the teachers agreed to extend the number of sessions for both Minecraft and LEGO as well as allowing the children to continue mapping during the lunch break as requested by the children.

Several limitations differed slightly between LEGO and Minecraft. For LEGO the inflexibility of the bricks posed a key challenge. The students would often remark on the hurdles faced throughout the building process in terms of the size, shape, and color of the LEGO bricks. This technical limitation at times affected the students' enthusiasm, creating frustration to some degree and affecting the playful dimension of the process.

The students also reflected on the limitations of the shape of the bricks that made it difficult to recreate realistic contours in the landscape and the curves of the hills. Ensuring the map looked realistic and true to their setting was important to the children. Jason (aged 12) stated:

When we finished the legend, I helped putting the houses on the hills and helped with the roads. But what I wasn't that happy with the hills because the bricks aren't round and they don't look exactly like the hills.

These limitations identified by the children are important to consider from a researcher and facilitator perspective as they might affect ongoing participation. If the participants are not proud of the final map and how it looks, this might influence their willingness to use the map as a platform to engage in dialogue about DRR with outside stakeholders.

Minecraft posed different limitations and challenges. The main challenge identified by students was about technical issues such as firewalls preventing access to Minecraft, the number of devices available, or the Internet being slow and making the mapping process patchy at times. At the same time, the children were proactive in solving many of the challenges they faced. For example, due to the restrictions of the number of devices that could be connected to the server at one time, 14 devices equal to 14 in-game avatars could collaborate within the world at one time (leading to approximately two children per avatar). This situation posed problems for the facilitators who did not have enough tablets and thought the children would be disengaged. But the children quickly adapted by sharing the devices and working in groups.

The LEGO map was 190×114 cm and represents an area of 3.12×1.92 km, the community boundaries identified by the 13 children involved. For LEGO the limitation was therefore that some of the children's houses were outside the mapped area, which somewhat hindered children's participation. The Minecraft map had the advantage of providing the possibility to go beyond the boundaries defined at the start of the process. However, a limitation lies in the fact that Minecraft requires a tablet, computer, or cell phone to visualize the finished map and the information that goes on it.

3.4 Children's Knowledge and Empowerment

Both the LEGO (Fig. 2) and Minecraft (Figs. 3 and 4) maps provided a visual representation of the students' knowledge and understanding of their place. They enabled conducting disaster risk assessment, discussing preparedness and evacuation, as well as planning for DRR. The children focused mainly on three main hazards: flood, drought, and wildfire. The Maraekakaho and Ngaruroro Rivers quickly

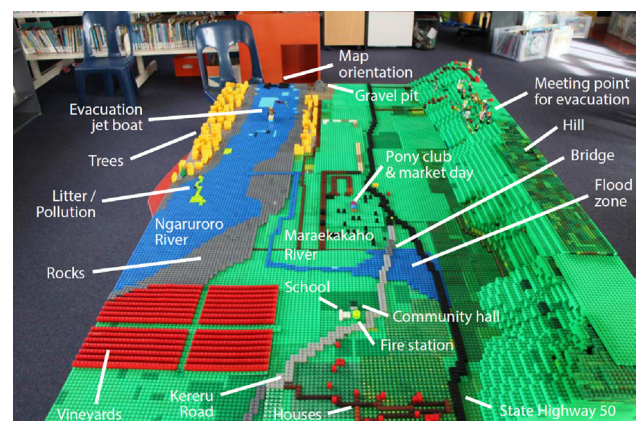


Fig. 2 LEGO map of Maraekakaho village produced by the children in the disaster risk reduction participatory mapping project, New Zealand 2018



Fig. 3 Village memorial



Fig. 4 Minecraft in-game memorial

became a focal point for debate. The children discussed their school exposure to flood and identified different households and assets adjacent to the rivers. They commented on certain community members who would be particularly vulnerable such as older people households or younger children in the school. LEGO and Minecraft were useful to locate potential meeting points for the exposed households in preparing for evacuation as well as existing and new escape routes. At the same time, they emphasized that the rivers presented opportunities to evacuate those affected by boat, which is something the adults (teachers, parents) involved in the discussions had not thought about:

Children said stuff and put things on the map that I hadn't thought of, like that the river was a capacity not just in the summer for putting out scrub fires, but also that you could use it to send jet boats down if the roads were blocked and people needed to evacuate and get into town or vice versa.

With both Minecraft and LEGO, the children emphasized the importance of the surrounding hillside explaining that should the school be flooded it would be a good meeting point to evacuate. They also thought of using the hillside as a preventive measure by evacuating farm animals when bad weather is forecasted:

The farmers are affected like if a flood happens or in the summer time when there is a drought because the animals' food is affected and that's how some people make their money. So, people watch the news so they know what weather is coming and they can prepare. They can put the sheep up on the hills so they are safe. (Jennifer, aged 12)

The rural setting with households working in the agriculture or horticulture industry (that is, orchards, vineyards, or sheep and cattle farms) influenced the discussions. The children were very much aware of the devastating impacts natural hazards like drought or wildfires can have on community members' income (most of them being farmers) and the need to prepare and have risk-reduction mechanisms in place. The LEGO and Minecraft maps also fostered discussions on the importance of certain resources and assets during disaster—such as, the fire station, community hall, telecommunication systems, and so on—and planning accordingly. For example, students using Minecraft recognized that the fire station was a critical resource in the face of disaster, and commented upon the movement of the fire station from its old location in a flood-prone area near the western side of the Maraekakaho River, to its new location in their school carpark following the 2007 flood (Fig. 5). This led to the children questioning different disaster planning decisions made in their community. They queried the appropriateness of the location of the rubbish station in a flood-prone area on the eastern side of the Maraekakaho River bridge, when this could potentially create health and environmental hazards should it be flooded. The children using Minecraft also discussed how the memorial is known as a meeting point to evacuate



Fig. 5 Maraekakaho village on the Maraekakaho and Ngaruroro Rivers, North Island, New Zealand. Maraekakaho flood in 2007. A: Maraekakaho School; B: Original location of the fire station; C: New fire station location; D: Maraekakaho River (rubbish station located to the south, just out of frame). Photograph by one of the community members from Maraekakaho, with permission for publication

should a flood happen. However, they critiqued this decision arguing it is in a flood-prone area and labelled the memorial as such in Minecraft.

One of the original goals was to enable the children, with the help of LEGO and Minecraft, to have a dialogue and take part in the decision making with outside stakeholders (for example, local council and adults) about disaster preparedness. However, this proved difficult in practice. The local practitioner and local people were somewhat impressed with the finished maps, including how much knowledge and understanding of disaster risk the children had about their own community. Yet, this did not seem to translate into empowerment through decision making involving children and adults. The reluctance from the local council and community members to use Minecraft and LEGO as tools for decision making did not seem linked to the tools themselves, but seemed to be a consequence of their perceptions of children and their capacity to engage in discussion about DRR in the local community. However, we did not conduct interviews with the local practitioners nor with other adults to gather their viewpoints to understand why this was the case.

4 Discussion: The 4 Ps (Participants, Play, the Process, and Power) as a Framework to Foster Children's Participation in Disaster Risk Reduction

LEGO and Minecraft mapping proved relevant in actively engaging children in DRR and fostering disaster preparedness. Four key aspects emerged as critical to both understand and foster children's participation (Fig. 6). These included: (1) the Participants and the capacity of the tools to cater to their diversity; (2) Play to foster an integrative, engaging, and creative process; (3) the Process, which through play was child-centered and helped foster ownership; and (4) Power (or empowerment), which through a fun and engaging process equipped the children with knowledge and tools to engage in discussion with adults.

4.1 The Participants

The question of who participated (and who could be excluded and/or who would exclude themselves) was essential to the co-design of this initiative and the fostering of genuine children's participation in DRR. Participation by essence should be inclusive and involve a wide array of participants (Cornwall 2008). Eventually, LEGO and Minecraft proved effective in equally involving children of different gender, age, ethnicity, cultural background, and socioeconomic condition. This was largely because most

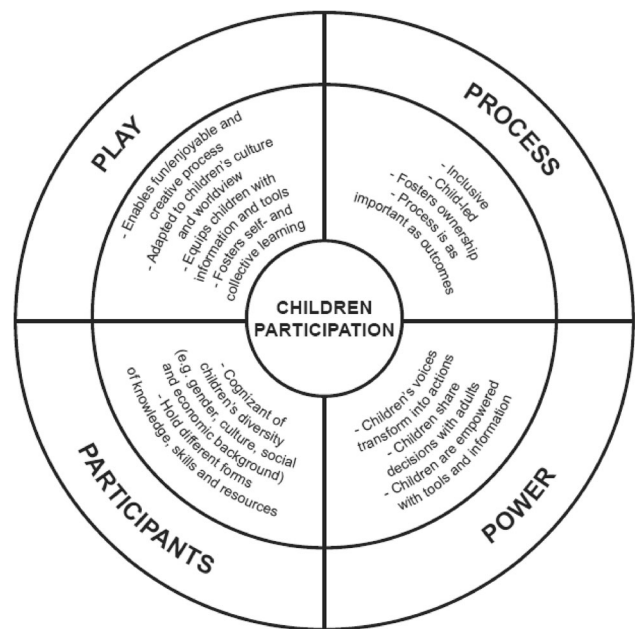


Fig. 6 The 4 Ps (Participants, Play, the Process, and Power) framework of children's participation in disaster risk reduction discussion

children played Minecraft and LEGO regularly. These games are visual and easy to use independently of any literacy or numeracy skills, making these tools accessible to a wide range of age groups and genders.

Child-centered DRR recognizes that all forms of knowledge are valuable, and not only the more vocal, educated or wealthy children should participate (Fothergill and Peek 2015; Gaillard et al. 2018). LEGO and Minecraft proved effective in fostering the participation of all the participants in DRR—without targeting or prioritizing certain children or groups. The results nonetheless indicate that it is necessary to carefully consider the age of the participants as not being too young or too old. Furthermore, both LEGO and Minecraft are highly popular in Western culture, but might, in other cultures, not be as grounded in the daily life of children. Therefore this needs to be carefully considered should these tools be used in a different sociocultural context.

4.2 The Process

The collaborative mapping process (that is, “working with friends”) through play, as revealed in the children's assessment, was a central outcome of the project. The importance of the process was also reflected in the limitations that revolved around elements that prevented that process to be smooth and fun, such as firewalls and slow Internet for Minecraft or the shape, size, and availability of certain bricks for LEGO. While these aspects could seem

without importance, they were critical to the children and ensuring a genuine participatory process in DRR.

For genuine participation to take place, it is essential that children take ownership over the participatory process. Hart (1997) developed a ladder of participation for children, an adaptation of Arnstein's "eight rungs on the ladder of citizen participation" (Arnstein 1969), which differentiates several levels of participation. Cornwall (2008) highlighted that children's contributions to the process can take many forms but are not necessarily synonymous with having a voice in decision making. With LEGO and Minecraft, involving the children from the start and in every step of the mapping activities was crucial to ensuring a genuine process. Yet, conducting the project in a school setting presented challenges to achieving authentic participation.

The literature generally emphasizes that fostering the participation of children in DRR is a process, not an outcome (Farrington et al. 1993; Cornwall 2008). In this study the process emerged as a key dimension of the children's participation. Nonetheless, facilitators should not dismiss the importance of the outcome to the participants. For the children, the accuracy of the information on their maps and how they would look was critical to them being actively engaged and then discuss DRR. Beyond working and playing with friends, they were highly interested in the end-result too, so they could show their map to outsiders and discuss both what they had done or could do with them.

4.3 Power

A genuine participatory process entails redressing unequal power relations between children and adults (Driskell 2002; Petal 2007; Wisner et al. 2018). Children do not have the same competence in communicating as adults, but this does not mean that information from children is invalid (Hart 1992). Empowerment therefore relates to equipping children with information/knowledge and tools so they can debate with adults, including experts and decision makers, as the process of participation cannot happen in a silo (Fothergill and Peek 2015).

LEGO and Minecraft enabled the children to share their knowledge about hazards, vulnerability, and capacities in their surrounding environment. The finished LEGO and Minecraft maps reflected this knowledge to the point that teachers and local people were impressed with the creativity and ideas regarding how to reduce disaster risk and improve disaster response. The children knew exactly about the information on their maps and had gained power through being able to have a dialogue with adults about DRR and development in their community.

Although LEGO and Minecraft were effective in equipping the children with tools to communicate with

adults, this did not translate into actual planning and empowerment in the sense of taking part in the decision making. The reasons why LEGO and Minecraft did not translate into decision making and actions for DRR was perhaps linked to adults' perceptions of children and their knowledge about reducing disaster risk—independently of LEGO or Minecraft as tools for DRR. Children's knowledge is often seen as inferior compared with adults' knowledge and many initiatives fail in fostering genuine participation because the adults still perceive children as resourceless and passive (Wisner et al. 2018). Children's empowerment thus requires a shift in adults' and institutional attitudes towards converting children's voices into actions (Mitchell et al. 2009).

4.4 Play

A central element to fostering children's participation with LEGO and Minecraft was play. The children ranked "being able to play with LEGO/Minecraft which is something we have at home" as the most important aspect of their experience. The fun, unstructured and overall playful dimensions of LEGO and Minecraft mapping led the children to truly enjoy participating in DRR, including requesting more sessions during and outside school time. Playing with LEGO and Minecraft appeared as a prolific and natural means of engaging the children in problem solving and knowledge construction about hazards and disasters. Maria Montessori (1964), one of the famous authors working on child development and education, described play as "the work of the child." She explained that much of play is practice for later participation with adults in work. Pioneering work from Rieber (1996) identifies four themes that relate to play: play as progress, play as power, play as fantasy, and play as self.

Through play, children develop cognitive and physical skills, explore, learn, create, and collaborate with others (Hart 1992; Rieber 1996; Granic et al. 2014; Toyoda 2016). In addition, play may motivate the players to find socio-culturally appropriate solutions through their own strengths, rather than forcing the participants to accept a universally "correct" solution defined by outsiders (Clerveaux and Spence 2009; Yamori 2012; Gampell and Gaillard 2016). Eventually, participation and play are strongly linked concepts: genuine participation is a critical component of play, and play does not exist without participation. However, to date there has been a lack of reflection on the capacity of play, as part of the participatory process, to empower children in DRR. The concept of play has long been central to children's education and psychotherapy (Johnson et al. 1987; Freeman et al. 1997; Frost et al. 2001; Landreth 2012) but has seldom been approached from a DRR perspective. The 4-Ps-framework

suggests the capacity of play to cater to a wide range of participants to actively engage them in the participatory process and for them to take ownership. In addition, play and games provide the means to empower children with disaster information they have produced through the process of play.

Aiming for playful activities to foster children's participation in DRR also emphasizes downward accountability towards the participants, that is, the children (Cornwall and Gaventa 2001; Hayward 2012). Enjoyment instilled by playing can only be "owned" by those who play. There is therefore an organic transfer of power and ownership of the participation process towards the children. Such transfer of power and downward accountability is one of the main obstacles observed in many DRR and development projects, including those focusing on children (Chawla 2001). Since play is a process in itself, it should be distinguished from the tools/games/toys that allow for children to play, as much as participation cannot be reduced to the so-called "participatory toolkits" that are only means not an end (Leal 2007; Chambers 2009). Games and toys such as LEGO and Minecraft are appealing to foster children's participation in DRR. They often stir immediate attention among practitioners, including schoolteachers, because they break away from the usual teaching and learning materials such as books. However, games and toys cannot be the main focus of CCDRR. There is, in fact, a myriad of options to foster context-specific and culturally relevant playful participation (Hart 1992; Auriat et al. 2001).

Playful participation of children in DRR cannot happen in a silo, isolated from adults' perspectives and decision making (Auriat et al. 2001). This is probably one of the main challenges associated with initiatives designed around play. Children's frequent powerlessness in decision making results from their unequal power relations with adults (Hart 1992; Hayward 2012). Therefore, adults need to partake in the participation process so that they can recognize the skills, knowledge, and resources of children, trust them and eventually transfer power to influence their everyday lives. What is playful to children may be less appealing to adults and vice versa. The use of LEGO and Minecraft reveals that play runs the risks for adults (that is, community members, practitioners) to take children's concerns, suggestions, and needs into account even less and perceive the game tools as "just child's play." Ultimately, this highlights that it is essential to carefully choose the tools that provide a platform for dialogue with adults while fostering play among children, as illustrated with the creation of participatory maps through LEGO and Minecraft to discuss disaster risk in New Zealand. The four Ps of the framework presented in this article thus need to be taken holistically. One cannot stand in isolation of the others.

5 Conclusion: Beyond Achieving the Four Ps (Participants, Play, the Process, and Power) of Children's Participation in Disaster Risk Reduction

Fostering children's participation in any DRR initiatives, as shown in this case study, entails focusing on the process through which children gain power to influence decisions that matter to them. For this process to be meaningful to children it often must be playful (Hart 1992; Hayward 2012). Play is essential to ground participation within children's worldview as well as within their networks of relatives and friends (Smith and Vollstedt 1985; Chawla 2001). Fostering children's participation in DRR therefore requires fully considering the Participants, Power relations as well as the Process and Play or the four Ps of the framework suggested in this study.

LEGO and Minecraft are tools that have the potential to provide such playful platforms for children to participate and gain power in the everyday affairs of their locality. The case study from New Zealand emphasizes some key opportunities and challenges for the 4-Ps-framework to fully embrace its objectives. The framework particularly emphasizes the importance of play in fostering children's participation in DRR—this, by extension, leads to stronger disaster preparedness. The latter has long focused on the process of sharing power towards children as participants. This kind of process has proved challenging so that children's participation in various dimensions of development initiatives often ends up being tokenistic if considered along Arnstein's (1969) ladder of participation (Hart 1992; Hayward 2012). Play provides an opportunity to facilitate genuine children's participation by grounding the latter in their everyday environment, an opportunity that has been recognized in fields cognate to the practice and study of development, especially psychology and education (Johnson et al. 1987; Freeman et al. 1997; Frost et al. 2001; Landreth 2012). This process is facilitated by the existence of multiple and diverse tools, games, and toys, that are increasingly used by practitioners. But the potential of this process has yet to be fully unleashed to address the unequal power relations between adults and children.

The 4-Ps-framework provides an overarching approach to pull together all dimensions of children's participation in DRR, especially play. This framework emerged as a result of the children's evaluation of the project, the teachers' feedback, and the researchers' observations. It is devised to guide both theoretical and empirical understanding of children's participation as well as the practice of DRR on the ground. The framework is not meant to be a rigid and normative template, nor does it constitute the only way to appraise participation with children (Hart 2008). It rather

provides a flexible approach for scholars and practitioners to consider local conditions, including when children's participation is not engrained within cultural norms and values yet desired by children themselves. It is also cognizant of the diversity of children's identities, knowledge, and skills at different ages. This framework is ultimately a contribution to both meeting the expectation of the United Nations Convention of the Rights of the Child and the ethical imperative to address the concerns of more than 2 billion children and adolescents under 18 years old worldwide.

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