Research Article

Samiullah Paracha*, Lynne Hall, Kathy Clawson, Nicole Mitsche, Fatima Jamil

Co-design with Children: Using Participatory Design for Design Thinking and Social and Emotional Learning

Abstract: This paper discusses leveraging design thinking techniques for involving children in serious game design in Japanese elementary schools. Our action research project approach accomplished two different goals: (1) to inculcate design thinking in pupils, and (2) to sensitize children on bullying victimization. Our approach uses a range of participatory design methods to distil design ideas from children and to support their design thinking aiming to boost children's creative confidence and develop social and emotional skills. Key findings from our project are: (1) children made valuable design contributions including realistic bullying scenarios, language content, user interface design, storyline progression, character profiles, coping strategies etc., and (2) participatory design and design thinking stimulated ethical reasoning, reflection and empathy in children on bullying victimization. Our approach is unique in the current design thinking landscape, because it moves from designing "thing" (object) to designing "think" (bullying sensitization). Future research should focus on highlighting ways how participatory design and design thinking enrich and complement each other. The significance of our paper stems from the simple standpoint that those participating in a design should gain from participating in the design process. Takeaways for practitioners are: (1) building relationships with stakeholders, especially children, (2) empathy and user research techniques, (2) translating field data into usable insights, (3) idea-generation and rapid concept development, (4) product co-prototyping, (5) user engagement and co-creation, (6) multiple perspectives on effective communication.

Keywords: Design Thinking; Participatory Design; Serious Games; Bullying Sensitization; Social & Emotional Learning.

1 Introduction

Design Thinking (DT) is a process that foresees steps to allow participants to analyze, synthesize, diverge and generate insights from different domains through drawing, prototyping and storytelling (Brown, 2009). It is an approach to learning that focuses on developing people's creative confidence (Carroll et al., 2010). Potential users are engaged in hands-on projects that build empathy, promoting a bias toward action, encouraging ideation, and fostering active problem solving. Using one's imagination is central in DT; it begins with the people that one is designing for and ends with new solutions that are tailor-made to suit their needs. DT consists of three phases starting with building a deep understanding and empathy with those that will ultimately be the users of any new social project, service or product that is developed (Lunch & Koningstein, 2017).

Numerous studies (Sim et al., 2016; Khaled & Vasalou, 2014; Paracha & Yoshie, 2011; Hall et al., 2006; Read et al., 2002) have shown that Participatory Design (PD) approaches with children both at the ideation stage and at the pre-build stage, can be beneficial, although there are concerns about the extent of, and the abilities associated with, children's participation. PD is a form of collaborative working, by which groups of users can influence design decisions (Sim et al., 2016). PD sessions are generally used to capture design ideas in which the participants are the target user group, for instance, children designing interactive games on bullying awareness and related coping strategies (Paracha & Yoshie, 2011). Typical PD

*Corresponding author: Samiullah Paracha, Faculty of Technology, University of Sunderland, UK, E-mail: samiullah.paracha@research.sunderland.ac.uk
Lynne Hall, Kathy Clawson, Nicole Mitsche, Faculty of Technology, University of Sunderland, UK
Fatima Jamil, Lahore University of Management Sciences, Pakistan

sessions involve end-users working with designers to propose and work through potential design ideas for a specific system. There are different models of running PD sessions in which design experts (software designers and researchers) work with domain experts (the end-users, children) to create designs. Sim et al. (2016) have acknowledged that depending on the way in which participatory sessions are set up, end-users' ideas will have varying impact on the final design.

PD for children's sensitization training is a theme that can be found in few serious games studies in the literature (Paracha & Yoshie, 2011; Paracha, Khan & Yoshie, 2008; Hall et al., 2006). According to Sim et al. (2016), sensitization is a learning process in which the participants are encouraged to reflect on past experiences to help facilitate envisioning future experiences. Serious games are designed with an emphasis on learning and reflection, as opposed to being purely for entertainment (Sim et al., 2016; Gee, 2007). The effectiveness of serious games for children's social and emotional learning has been widely recognized (Cheong et al., 2015; Olenik-Shemesh et al., 2014; Paracha & Yoshie, 2013; Campos et al., 2013; and Hall et al., 2006).

PD is an established, user-centred design approach frequently used with children in serious game design. However, one of the main disadvantages of PD is the negligence towards user and stakeholder experience of the actual design approach. In contrast, design thinking involves both thinking about the users and encouraging the user to think, through providing appropriate techniques to explore and solve problems. Unlike traditional PD, design thinking aims to give something back, to provide participants with a take-away, not just the solution or consideration of one problem, but a toolkit to approach other challenges.

This paper explores the use of PD methods to inculcate design thinking in children in Japan, designing a serious game, Shimpai Muyou ("Don't be afraid" in English), for social and emotional learning in the domain of bullying. Our research question is: how can we engage children in serious game design to foster design thinking and their social and emotional competence to challenge bullying? The design of Shimpai Muyou enabled us to explore the potential to use PD to accomplish two different objectives at the same time: (1) inculcating design thinking in pupils and (2) sensitizing children on bullying victimization.

Section 2 discusses the relationship between DT and PD, followed by a debate on co-designing with school children. Section 3 discusses the action research and approach undertaken to develop Shimpai Muyou. Section 4 outlines the methodology adopted to carry out two PD workshops at Japanese elementary schools. The key findings, innovations and contributions are provided in Section 5 and discussed in Section 6, concluding that using PD methods can provide an experience for children that inculcates design thinking and enables social and emotional learning.

2 Relationship between Design Thinking & Participatory Design

Design Thinking has gained popularity in recent years, and it is now seen as an exciting problem-solving approach in different fields (Santos et al., 2017; Lunch & Koningstein, 2017; Stephens and Boland 2014). Traditionally design has been treated as a downstream development process. What design thinking embraces is engaging the designer on the project from the outset. This design driven innovation strategy is the essence of design thinking (Behrendorff, Bucolo & Miller, 2011). Brown (2008) discusses that the advantage of this approach is strategic, where compared to the traditional use of designers; design thinking creates dramatic new forms of value to the end users. This is able to occur because at the earliest stage of the project, designers must collaborate with the end users of the product or service. Hence the advantage of design thinking is that it can suggest creative alternatives to the assumptions made in developed societies/markets. Design thinking is a tool for imagining these experiences as well as giving them a desirable form (Behrendorff, Bucolo & Miller, 2011). But before a designer can add form to potential user experiences, they must consider the meaning behind what a potential design solution may be for the end user. This is the essence of design driven innovation (Verganti 2008; Behrendorff, Bucolo & Miller 2011).

DT and all that it stands for today did not directly come out of nowhere– it has a history. According to Di Russo (2012), DT was a realisation through the evolution of different (collaborative) design process methods that were developed to improve and extend design to other areas of practice. Investigating the historical roots of this phenomenon is necessary in order to contextualize the success and definition of contemporary design thinking practice. The purpose of doing this is to objectively clarify the history and evolution of design thinking which has been muddy and conflicting to date. Di Russo (2012) opines that it all started with PD, which was introduced in the 1960s, but was popularized in the late 1980s.

In the early days, participatory methodology was seen most commonly in urban planning until recent developments in design gave this method its name. However, the history and development of PD in and of itself, independent from design thinking, could be traced all the way back to Plato's Republic (Di Russo, 2012). Grass roots democracy was once the heart of participatory methodology and is an established method used for centuries for the development of a harmonious society. In the 1960s, during the design methods movement, PD was gaining momentum through research. Dubbed the Scandinavian approach, PD was about integrating end users into the development (prototyping) phase of projects. Technological developments during the end of this decade saw PD shift from a social method to a technological one. According to Di Russo (2012), prior to the adoption of PD in technology, systems design was the go-to method for engineers prototyping within an iterative framework.

As PD progressed into the 1980s, it became synonymous with the emerging field of interaction design. Many of the techniques used were borrowed from science, such as usability testing. Others included mock-ups, prototyping and even role playing. Usability was dominant, but emotional response to gadgetry was largely ignored. In some instances, user testing was abandoned, when users' decisions conflicted with those of the stakeholders and the designers. Di Russo (2012) opines that in response to this end-user dilemma, discussions surrounding co-design (co-operative design) or collaborative design began to take place. This alternative method aimed to transform passive users into co-operative designers.

The most significant contribution to the transformation of user development in design was introduced by design theorist Norman (2002). He re-defined PD into what he coined as user-centred design. User testing became less about usability and more about a user's interests and needs. Norman (2002) favoured user-control and humanised participatory and system design by "making things visible". This was to ensure users could discover errors and have control over resolving them. The placement of user at the centre of the development process highlighted the benefits of understanding user experience over user testing. Owing some of its methodology to behavioural sciences, user-centred design emphasised experience over efficiency and adopted a more humanistic approach with the involvement of the user throughout the development of a product or system. User-centred design grew out of speculations towards elevating users from guinea-pigs to co-developers of systems during the participatory trend. This new methodology incidentally spread into broader areas of industry and practice (Di Russo, 2012).

PD is the most common way to include children in the design process. A growing body of literature has emerged, since the late 1990s, on children's participatory roles as informants and design partners from initial technology brainstorming to prototyping to final evaluation phases (Druin et al., 1997, 1999a,b; Druin, 2002; Hall et al., 2004, 2006 and 2015; Danielsson & Wiberg, 2006; Read et al., 2013; Khaled & Vasalou, 2014; Read, 2015; and Gennari et al., 2017). The central concern is how collaborative design processes can be improved by participation of the people affected by technology design (Simonsen & Robertson, 2013). A number of PD studies concern supporting children's input at specific stages of the design process through low or high-fidelity prototypes. For example, Hall et al. (2004, 2006 and 2015), and Read et al. (2013), and Read (2015) have involved children as "informants" in design and as "participants" in evaluation.

Despite its uptake within the wider interaction design community, PD does not guarantee higher game effectiveness. In this respect, DeSmet et al., (2016) have discovered more support for "informant roles" than for "co-design roles". Similarly, Khaled & Vasalou (2014) also found that efforts to engage children as co-designers within serious game design have proven difficult for: (1) lack of deep tradition of participatory game design, (2) children not being fluent with both domain content and game design, and (3) difficulties for game designers to incorporate and leverage children's expectations. Read (2015) also raised some practical, methodological and ethical concerns in terms of recruiting children in usability and evaluation studies, and ensuring that they can contribute in meaningful ways.

Some researchers have viewed children as morally incompetent, inexperienced and incapable of making rational decisions within projects (Cunningham, 1996). According to Kellett (2009), this is epitomized in the paternalist stance of so-called "child savers" (Archard, 2004) who took decisions on children's behalf as a protection against them making potentially harmful mistakes (Mayall, 2002; Cockburn, 2005). This perspective has been robustly challenged by liberationists, who argue that even young children can make rational decisions within projects (Hyder, 2002). Wyness (2001) takes a broader view, arguing that children's right to involvement in decision making threatens to destabilise the adult paternalist stance since it requires a shift of power and may openly conflict with adults' claims that they have the child's "best interests" at heart. Franklin (2002) further weakens the paternalist argument by claiming that children need to be given opportunities within projects to gain experience and points out that adults, who are

deemed to have the necessary experience, often make the wrong choices but are not excluded from doing so on the same grounds.

Read (2015) argues that many studies fail because the adult evaluator is too far removed from the children in terms of understanding their vocabulary, their abilities, their context, and their motivations, so the experience at best is bad, and at worst is damaging for the children participating. These sorts of studies may well expose many problems with software and gather some half-useful opinions, but they damage the reputation of the children-computer interaction community and do little to encourage children to explore science and scientific inquiry, which one would hope might be a by-product of participating in a well-structured usability study.

According to Kellet (2009), children are party to the subculture of childhood, which gives them a unique "insider" perspective critical to the design of methods that will generate appropriate data. Insight into their peer culture is just as valuable in the analysis of these data. In a similar way to children's meaningful participation in serious game design can provide significant value for children's learning e.g., strengthening their domain knowledge, kinesthetic learning and so on. Khaled & Vasalou (2014) assert that it is imperative to continue building our understanding of how PD methods can apply to serious games, such that the aspirations of PD can be achieved through serious game design processes. The new sociology of childhood celebrates children as social actors and agents in their own lives. Facilitating meaningful participation is a further endorsement of this position, finally laying to rest sepulchral perspectives of children as "adults in waiting" or "human becomings" (Kellet, 2009).

The focus of PD with children is the product or experience under design with outcomes being used to feed into future iterations. PD methods are typically very enjoyable for children, however, beyond participating in a fun experience, PD provides limited benefits or value to the child. For example, although PD frequently takes place in a classroom situation, how such participation affects the child's learning has not received much consideration, beyond the learning of design skills within prototyping activities. A further consideration for the need to provide value through the PD experience to the child participant is that engaging in PD does not necessarily guarantee that the child will ever use the product, with much PD happening early in the development process.

PD with children should not be seen as a mechanism solely to inform the developers, but instead should focus on what value the child gains from experiencing the technique. As discussed in this paper, PD can be created

to explicitly add value, incorporating the perspective of design thinking to provide children with new skills and approaches for the current challenge and for problem solving in general.

3 Shimpai Muyou: Taking Design Thinking to Japanese School

Recognizing the challenges of this imperative domain, the project developing Shimpai Muyou was launched to create one of the first ICT interventions on bullying victimization in Japan. The project exploited state of the art technology to provide immersive virtual role play with intelligent characters of bullying-specific behaviour and intuitive interaction (Paracha, Khan & Yoshie, 2008). Contrary to the Japanese top-down design culture, the project committed itself to a learner-centred design approach in which children would have a major role (Hall et al., 2006). The paucity of scholarly work on Japanese bullying further motivated the need to involve children in the design and development. The project aimed to bridge the gaps, in the Japanese context, with regards to:

a) exploiting children's creative and design potentials through PD approaches;

b) extending the knowledge base that contributes to an improved understanding of the role of design thinking in K-12 classrooms;

c) allowing children to develop a serious game intervention on bullying victimization at school through sensitization training on social and emotional learning.

Our research strategy for creating Shimpai Muyou was action research as a reflective process of problem solving where teachers and game designers embedded themselves in the "community" of school children supporting design thinking, and interacting with them on equal footing in the tradition of PD. The literature on action research reveals that its goal is reflective practice, and through this ultimately striving towards change and improvement (Leitch & Day, 2000; Corey, 1952, 1953; Carr & Kemmis, 1986). Identifying reflection as the engine of action research processes, which are conceptualised more holistically, adds to the learning possibilities for all those involved, and the richness of what might otherwise be continuing adherence to restrictive action research paradigms and practices.

Leitch & Day (2000) associate reflection with thinking and is judged to involve the cognitive processes of both

Figure 1: Children's involvement in the Shimpai Muyou design cycle.

"problem finding" and "problem solving", concepts which continue to fascinate in cognitive psychology (Arlin, 1990; Csikszentmihalyi & Sawyers, 1995). Schön (1983) coined reflection-on-action and reflection-in-action as the two forms of reflective thinking. Johnston & Badley (1996) defined reflective practice as the "acquisition of a critical stance or attitude towards one's own practice and that of one's peers". Dewey (1933) considered reflection in practice as having a moral base, where professional actions would be treated as experimental, and the individual would reflect both on their actions and their consequences. Thus, while a reflective practitioner may be concerned to improve practice and to develop additional competence, what defines the effective reflective practitioner is more a set of attitudes towards practice based upon broader understandings of self, society and moral purposes than those which seek simply to increase efficiency in relation to "delivery" and narrowly conceived achievement targets (Leitch & Day, 2000).

Compared to the West, co-creation or PD with children has no strong tradition in Japan. Inspired from the new research paradigm, "engage in research *with* rather than *on* children", the Shimpai Muyou project introduced for the first-time PD with children as a part of anti-bullying efforts in Japan. A pragmatic stance, as seen in several

studies (Hall et al., 2004, 2006 and 2015; Read et al., 2013; Khaled & Vasalou, 2014; Read, 2015), was taken in the project to support children's input at specific stages of the design process through using a number of methods adapted to their needs. Both low-fidelity (paper drawings, role-playing drama & comicboarding) and mid or high-fidelity (digital storyboarding & interaction with the prototype) techniques were applied, depending on the need and maturity of the design process.

Children as "informants", participated during the design and development stages of Shimpai Muyou serious game and as "participants" in the evaluation phase (Figure 1). The following are some key areas which required their input: (1) understanding of Japanese bullying dynamics from a child's perspective, (2) development of bullying scenarios, characters' roles, emotional constructs, bullying locations, language and gestures, and (3) validating and improving the user interface, ease of use, urge to play, game effectiveness in relation to ethical reasoning and empathic reflection, immersion and appeal.

Through reflection on the design of Shimpai Muyou, it became clear the PD experience could be used not only to co-create the game, but also as a means to provide children with opportunities to engage in, and apply design thinking. Using PD we aimed to explore

Figure 2: Fictional Inquiry sessions with Japanese children.

if design thinking, following the Stanford University's d.school model (Banerjee & Gibbs, 2016) of empathise, define, ideate, prototype and test, could be integrated into PD. In particular, we aimed to support the children in empathising and beginning to develop an empathic mindset as a way to address challenging problems of bullying and other similar problems. Our second learning goal with the PD was to sensitize children on bullying and in doing so, in line with the game's objectives to weaken the bond between the bully and the peers by evoking empathy, ethical reasoning and reflection, and eventually encouraging bystander intervention behaviour.

4 Methodology

4.1 First Participatory Design Workshop, Oita, Japan

Paracha, Khan & Yoshie (2008) and Paracha & Yoshie (2008) reported the first PD workshop with 30 children of age between 7 and 12, held in Oita. The young participants were divided into 6 groups (each group comprised of 5 children). Among them were 2 North American and 3 Hispanic children, the rest of the 25 children were of Japanese origin. To recruit children to participate in the design process, Parent-Teacher Association (PTA) was contacted to get ethical approval. PTA is a panel of parents and educators at Japanese schools who help to ensure the safety of child subjects and who assist in making sure that rights of children are not violated. Children were selected by their teachers at school based on their conduct as bully/ victim/ bystander/ bully-victim.

Three PD methods were used including brainstorming, comicboarding and Classroom Discussion Forums (CDFs) for the purpose of generating game narratives and mechanics. Outputs included children's comicboards depicting bullying scenarios, language and gesture contents. Data was obtained through CDFs and questionnaires (bullying, friendship, empathy and picture story). Thematic analysis focused on how characteristics of each method influenced idea effectiveness.

a) Fictional Inquiry

Fictional Inquiry or brainstorming activities were designed for children to encourage a "free flow of ideas out of which may grow the next great innovation" (Fails et al., 2012). Children were told to be "Detectives" and they had to catch bullies on planet Mars. They drew scenes depicting different bullying situations (Figure 2). After completing their artifacts, children presented them through slide projector. The illustrations were evaluated using established visual theme categories. Following theme development, study team members individually analysed the pictures.

b) Comic Boarding

Short comic stories were distributed for reading and children then created comic strips as a continuation of an existing story. Japanese children were familiar with this technique as part of their curriculum. It was noticed that by using a familiar bullying construct, filling in a partially completed comic strips, and skilled artists drawing ideas dictated by children provided more valuable information

Figure 3: Comic boards filled by children to complete bullying stories.

Figure 4: Classroom Discussion Forums with pupils.

than other brainstorming activities. Following theme development, study team members individually analysed the comics (Figure 3).

c) Classroom Discussion Forum

Some researchers such as Hall et al. (2006), have had great success with the CDF approach in obtaining qualitative information from children. So, this method was used to allow children to verbalize their opinion on different design elements. Japanese children found this method more comfortable to speak about their bullying experiences, as it resembled their daily circle times. The CDFs (Figure 4) were recorded and transcripts were uploaded to NVivo for template analysis.

4.2 Second Participatory Design Workshop, Yufu City, Japan

Paracha & Yoshie (2011) reported the second PD workshop that was held in Yufu City. Ethical approvals for visual data was obtained from the PTA with assurance that the data would be strictly used for research purposes only. Children were selected by their school teachers
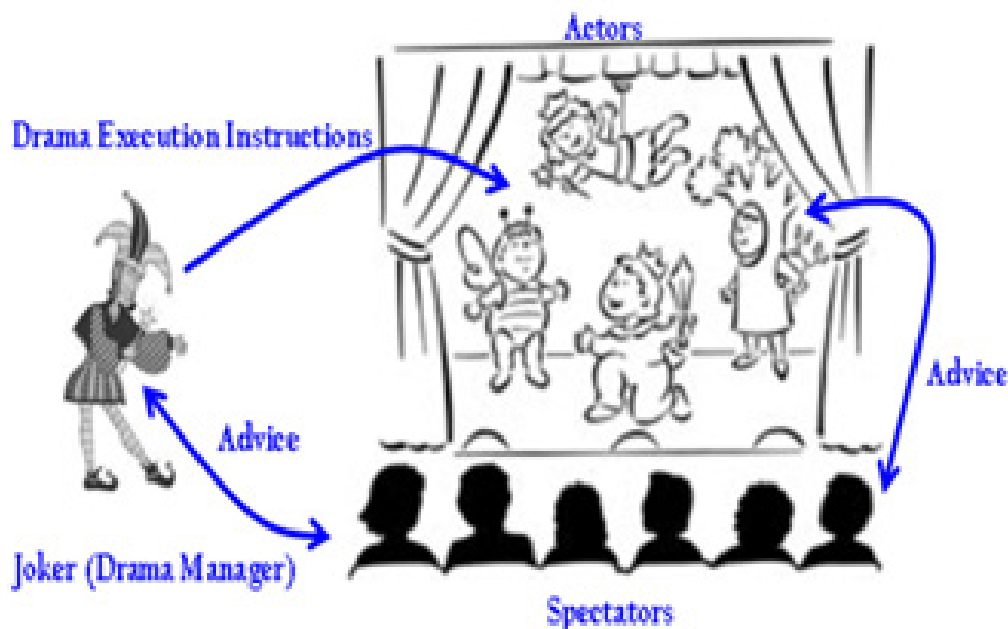
Figure 5: Theatre of the Oppressed technique.

based on their observation as bully/ victim/ bystander/ bully-victim. Thirty children (7-12 years old), including 28 Japanese, 1 South American and 1 of East European descent, volunteered for this workshop and were divided into 5 groups (each group comprised of 6 children). It was noteworthy that the child-participants selected for the two workshops were not the same. The collaboration was carried out during slightly mature stages of game design. Some novel PD methods included Boal's (1993) Theatre of the Oppressed, CDF, and Digital Storyboarding.

a) Forum Theatre

Forum Theatre was a "Theatre of the Oppressed" technique (Boal, 1993) that began with the enactment of a scene in which the performers tried unsuccessfully to overcome an oppression relevant to that particular audience (Figure 5). The "joker" or drama facilitator addressed the audience and invited the spectators to replace the performers at any point in the scene if they could imagine an alternative ending leading to a solution. Based on the audience's ideas, the performers did the scene numerous times with different interventions. This allowed both the performers and the child-audience to engage in a dialogue on bullying victimization, to examine alternatives, and to create a "rehearsal" for real bullying situations at school (Clark, 1998).

The researcher used role-playing and Forum Theatre techniques for the first time in Japan to teach pupils how to deal with school bullying. Children were encouraged to express their anger, frustrations, and prejudices and then engaged in scene work and role-playing. Forum Theatre began with a bullying scene work followed by CDF. Pupils discussed violence on the playground. Students, divided into small groups, sat in a circle. Each group was assigned to bully, victim and bystander actors on the stage to support.

Children were encouraged to transpose their own feelings onto the actors and explore different coping strategies in their process of understanding bullying. They openly verbalized their emotional issues and acted out solutions. CDF were used to capture qualitative data required for creating believable scenarios and agent design. The topics covered were: (1) level of interest and enjoyment after interacting with the actors and especially the Joker character, (2) empathic/ emotional reactions to the bullying events/ characters, and (3) types of advice, endings and educational goals. The drama session with children was recorded and transcripts were uploaded to NVivo for template analysis.

Figure 6: Digital frames created by children depicting bullying scenes.

b) Digital Storyboarding

Next, participants were introduced to digital storyboarding to elicit causal inferences between characters' actions and consequences (Khaled & Vasalou, 2014). Digital storyboards offered an easy way to express bullying encounters at school, emotions and feelings. Children entered the utterances into speech or thought bubbles (Figure 6) that supported the creation of realistic conflict scenarios with appropriate language content for the Shimpai Muyou environment. However, as compared to digital storyboarding, the comic-style convention of storyboard was much faster. Pupils responded more quickly to hand-drawn drawings than something produced digitally.

c) Exposure to Preliminary Prototype

Towards the end, children were exposed to an underdeveloped version of virtual bullying scenarios (Figure 7). They completed a written questionnaire that enquired about the appearance, believability of the characters and their overall impression of the virtual bullying scenarios. This evaluation was aimed at obtaining characters children would relate and at the same time identify with.

Overall, children reacted favourably to the bullying scenarios by empathizing with the victim characters in virtual bullying scenarios and developing feelings about how they were treated and what became of them. Thematic analysis was performed to determine the idea effectiveness. The instruments and methods used in the workshops had merged the interdisciplinary input with a diverse set of evaluation techniques into a coherent, structured activity, sufficiently flexible for both the lab and the classroom (Hall et al., 2006).

5 Key Findings, Innovations & Contribution

The primary outcome of the design process was to gain children's input on bullying types, roles, gestures and content; on storyline design and progression and correct language configuration for the bullying scenarios; and to bring relevant improvements in the interface, storyline, character profiles and coping strategies according to their needs and preferences. Children's input from the children made a significant impact to Shimpai Mayou's design, story and interaction.

The different expertise of the participants led to differences in types and strengths of design ideas produced. Children in the second PD workshop (also see Paracha & Yoshie, 2011) had a high degree of game literacy as compared to those participating in the first workshop as reported in Paracha, Khan & Yoshie (2008). As a result, pupils from the second workshop were able to contribute a total of 156 unique design ideas as compared to the 43 unique design ideas in the first. Although some of their opinions did not align with Shimapi Muyou's learning objectives, most of their ideas did support the notion of an ethically notable serious game on bullying (Table 1).
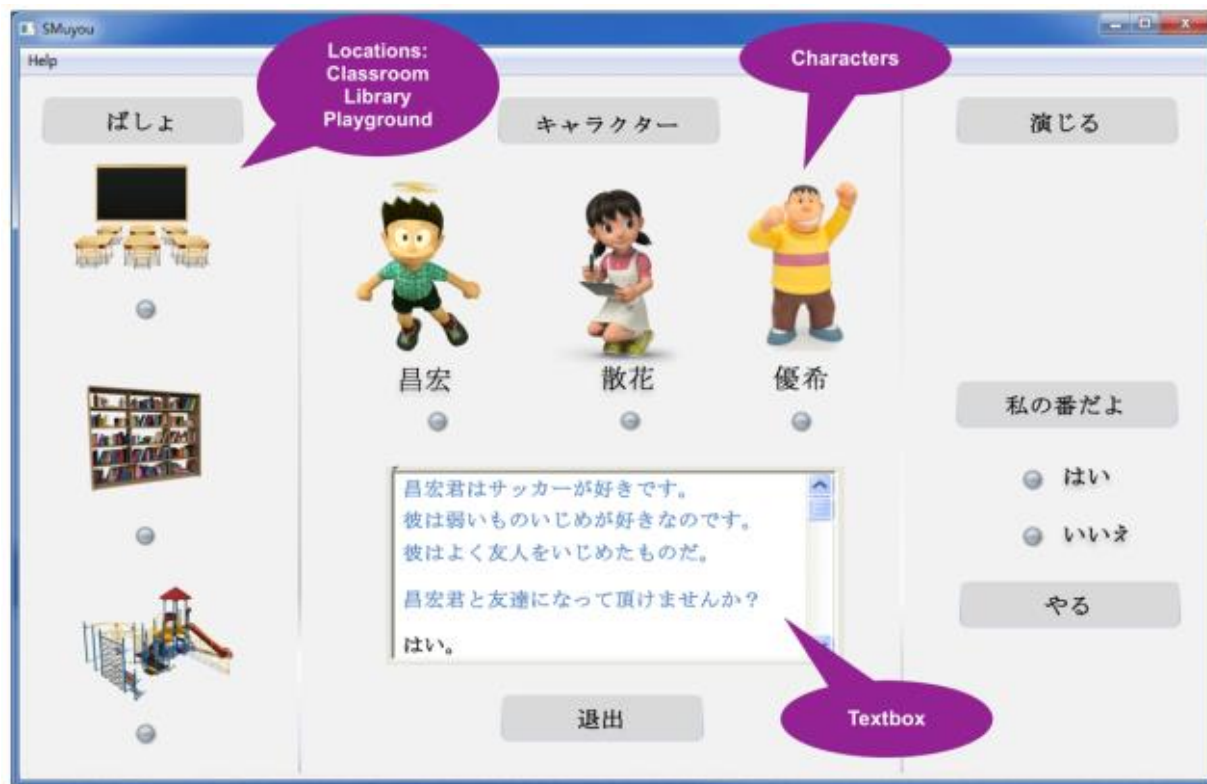
Figure 7: Interface.

Table 1: Type of children's design ideas.

Design ideas	Count
Animations, colours, graphics	22
Background scene	13
Main characters, avatar	15
Age/gender user choices	6
Interactions	20
Sound, text, voice	25
Navigation	21
Likes, dislikes, experience	11
Input	14
Help functions	9
Total	**156**

The process of developing Shimpai Miyou had a complementary goal to contribute to social and emotional learning in relation to bullying. Sensitization training in primary schools is a crucial part of creating a safe environment for all children. Some children often face bullying and lack of acceptance from fellow pupils as well as from school teachers and administration. Engaging students in collaborative design activities through PD techniques such as Fictional Inquiry, role-playing drama,

comicboarding, digital storyboarding and classroom discussions provided needed tools to teach values, perspective-taking, ethical reasoning, empathy, reflection and inclusive principals to pupils in the classroom and the community.

The PD approaches provided new ways for children to think about problems, solutions, challenges and opportunities, with innovative ideas emerging both for the game and for coping with bullying. Feedback from the school indicated that collaborative design activities were viewed as a pleasant learning experience by all, particularly Theatre of the Oppressed. Our approach moved from designing a "thing" (object) to designing "think" (bullying sensitization) using PD methods to foster design thinking skills. We found that:

a) Fictional Inquiry was an effective technique, providing children with a means to explore and depict bullying in a fictional context. Brainstorming fictional inquiry provided an understanding of children's views on bullying, types, situations, characters and language involved.

b) Comicboarding and digital storytelling offered the developers useful information on daily life at school, emotions, empathy, bullying scenes and language

content. Creating a narrative with visual elements and discussing these enabled the children to explore their scenarios and approaches, with language content, gestures, coping strategies that children used in dealing with bullying, character impressions, emotions and empathy considered. For the children, empathising with the bully, the victim and the bystander resulted in greater understanding of a range of bullying situations and of possible solutions for coping with bullying,

c) Theatre of the Oppressed supported the creation of the bullying scenarios, types of bullying and characters, coping strategies and provided context and storyline progression. The benefits of theatre work with Japanese children were great. Students were empowered by voicing their ideas and having them heard. They experimented with different choices and consequences in a safe environment. Eventually, these activities can lead to growing self-confidence and self-esteem of children in the real world. Theatre of the Oppressed was the most effective approach we used, with children stimulating a range of solutions and approaches, empathising with the characters and thinking about a variety of perspectives when determining actions, feelings and reasons for how a bullying scenario may develop.

d) Exposure to the Prototype offered different views on characters, storyline, empathy and gender, as well as acceptability of the look and feel of interface. Overall, children reacted favourably to Shimpai Muyou by empathizing with the victim characters and developing feelings about how they were treated and what became of them.

e) CDFs provided a typical in-classroom context where children verbalized their views on bullying, bullying scenarios, speech acts, coping strategies, bully/victim's impression, role of empathy and values. Whilst the CDF replicated classroom approaches, the content about the challenging social issue of bullying and the approaches that children had used to help design Shimpai Muyou were not typical of the classroom with the CDFs resulting in lively, broad ranging discussions with multiple perspectives, solutions and understandings proposed by the children.

Limitations of our work include the relatively small sample and the focus on one social and emotional learning issue. In addition, the impact of participating in the workshops was not formally tracked, however, as the team included teachers, ongoing interactions with the children identified that participation had influenced the children's approach to problem solving and contributed to their social and emotional development. For example, children adopted design thinking approaches and came up with a myriad of ideas. One submission from a Japanese child was a robotic friend that can protect him from bullies at school. Another child came up with an idea of CCTV cameras to be installed in the classroom, library and playground to report incidents of bullying to the principal and teachers. Perhaps this and other prototypes were not related to Shimpai Muyou design, but design thinking gave Japanese children the freedom to reframe questions, come up with new ideas, prototype and test.

Similarly, using Theatre of the Oppressed stimulated creative imagination in children and gave them the skills necessary to face the world, to understand it and perhaps to change it too. At the end of the role-playing session, some children, who were shy to participate in the beginning, expressed their desire to come to the stage and perform different roles. This indicated that children liked the interactive role-playing on bullying awareness. Experience and skills acquired during the Shimpai Muyou project, helped us to apply PD to sensitize children on growing drug usage and delinquency problems in Afghanistan and Pakistan (Paracha et al., 2009; Kabiri & Paracha, 2016).

In addition to raising children's awareness of bullying and excitement and interest demonstrated by them, we observed that participation in the PD workshops reduced the number of bullying incidents and improved the quality of children interaction. This was reported by teachers in the weekly staff meetings. Likewise, parents reported during Parent-Teacher meetings that children discussed with them the harms of bullying at home and ways to handle conflict scenarios at school involving choices based on empathy, tolerance and human values. As these examples identify, this approach to developing and applying design thinking to bullying using PD methods provided an effective pedagogical intervention.

6 Discussion

PD and design thinking, especially children's involvement, is not a norm in the Japanese top-down technology design culture, as such Shimpai Muyou was one of the first serious game projects that has introduced a design culture, which recognises the creativity of children in the search for new solutions of emotionally sensitive issues. Applying PD and integrating perspectives from design thinking, resulted in the children engaging as active collaborators who both gave and gained from the experience.

The PD workshops were effective for the developers, yielding output that was novel and of quality e.g., types of bullying situations at school, emotions, empathy, coping strategies, language and gestures of bully or victims. The results of interactive theatre, comic and storyboarding informed meaningful emotional and ethically notable scenario design. At the same time, they provided children with an opportunity to engage in immediate ethical reflection on school bullying.

Sensitization training on bullying, as seen in Western schools, is not offered to Japanese pupils. The PD session provided novel approaches to stimulate ethical reasoning, reflection and empathy in children on bullying victimization. Providing Japanese children with novel PD tools and methods such as digital storyboarding, Theatre of the Oppressed and CDF allowed children to become actively involved with the bullying problem and potential solutions, with the workshops enabling them to empathise, ideate, define, prototype and test.

Of all the instruments and methods developed, Theatre of the Oppressed (Boal, 1993) was the most useful in terms of guiding the design and development processes. It offered up-to-date information from children on realistic bullying scenarios, storyline, speech acts, creating new scenes, coping strategies, bully/victim impressions, role of empathy, friendship and values. This interactive role-playing offered sensitisation training to children about the harms of bullying, role of empathy, perspective-taking and moral anchor in what works best to create safe school for all. Using the Theatre of The Oppressed techniques was also particularly effective for developing design thinking.

Children were able to create scene work that reflected the world, and apply new techniques and approaches to create meaningful experiences. Such reflection helped them understand themselves better. They were able to discuss and act out solutions to problems when they felt oppressed or victimized. The children felt empowered to know that they had a voice in the world. By rehearsing that voice in scene work in the classroom, they acquired a useful tool for exercising their voices outside of the classroom. Believing that they could make a difference in their lives, empowered children to make a greater difference in the school and community.

In response to the findings from the Shimpai Muyou research, the Association for Promoting International Education and Yufu City Board of Education supported an intervention in Yufu city schools (including: Tsukahara, Yufuin, Kawanishi, Yunohira and Shonai Elementary Schools) to use the Theatre of the Oppressed techniques in the classroom in order to sensitize children on bullying. In addition, the Japanese board of education started bi-annual "Teacher Education and Professional & Development Workshop Programme" for teachers to learn and practice innovative methods for learner-centred teaching, using PD techniques discussed here.

This work brings forward many important and interesting issues related to PD and design thinking with Japanese children. It has highlighted the importance of engaging children in the design process with several advantages to developer and child participant: (1) sensitising children on emotionally sensitive issues that eventually prevent school bullying; (2) developing design-thinking skills in children to become better problem solvers in the future; and (3) maximising the potential success of a product. Japanese game researchers and designers should be able to incorporate similar best practices and plan several feedback loops in conceptual, elaboration, construction, validation and tuning phases of game development. This would help the nascent Japanese serious gaming community to mature quickly and engage in a more ambitious work in ill-defined domains.

The potential of PD and design thinking to be used to explore challenging social and emotional issues for children is apparent. However, through PD typically being considered as an input mechanism to system design, its pedagogical potential has received little interest. In particular, conflict resolution researchers have not given sufficient attention to PD. Whilst it is unlikely to be feasible to develop applications and IT interventions for conflicts and calamities as they occur, PD can offer a low-cost, enjoyable, useful approach to enable design thinking, supporting discussion, reflection, resilience and resolution, both immediately and in future activity. Conflict resolution contexts offer intriguing opportunities for PD with a need for research into how PD and conflict resolution could enrich and complement each other.

This work contributes to the new research paradigm of the 21st century of "research *with* rather than *on* children". Through reconsidering PD as more than a technique to inform developers, we have considered how PD can add value supporting design thinking to consider challenging social and emotional issues such as bullying. Opening up the innovation process for the people of Japan, implies moving from the dominating technocratic view of innovation to a democratic design where differences and controversies are allowed to exist, questions are raised and possibilities explored. Using PD can support children in applying and experiencing design thinking, providing alternatives attuned to children's creativity and enabling them to express their opinions and ideas, providing them with new ways of thinking about, and solving problems.

7 Conclusion

The use of PD for DT and Social and Emotional Learning, as documented through the case study earlier in this paper proved to be an excellent example for serious game researchers and designers to engage with their end users. As the product scenarios are fluid in nature, these become effective prototypes for extracting not only opinions of end users, but allowing the end users to actively co-design the system which is fundamental to its success. The study achieved the research objective of engaging users in serious game design to foster design thinking and their social and emotional competence to challenge bullying. The Japanese board of education directed schools to apply PD techniques to foster design thinking and invoke ethical reasoning, perspective-taking and reflection in children, as implemented in Yufu City schools. Although Shimpai Muyou aimed at anti-bullying education, with minor modifications in the future, the approach of using PD with design thinking could become an effective intervention on many social issues, such as sexting, drug-abuse and gender-based violence.

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