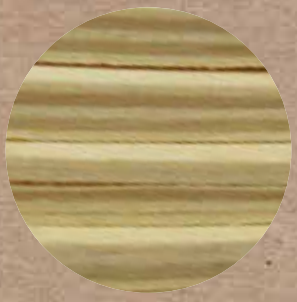
# Tangible ideation



## How to design *for* and *with* children?

Aalto University

Bang Jeon Lee

*Bang Jeon Lee* is a designer/researcher and educator. Her background is industrial and furniture design, and her main research interests are participatory design/co-design and user-centred design with a particular focus on child-centred design and research. She has been actively working both in academia and industry in Korea and Finland, as well as conducting various child-related design and research projects since 2005. She completed dual bachelor studies in industrial design, and woodworking and furniture design at Hongik University, South Korea, before moving to Finland to gain a deeper understanding of furniture design within experimental and user-centred approaches, concerning both functional and aesthetic perspectives. She worked as the director of design and research team at an urban landscaping company in South Korea, focusing on playground and play equipment design, after she completed her master's study at the University of Art and Design Helsinki, Finland. After that, she came back to Finland again to conduct her doctoral study in order to explore a way to communicate and collaborate with children based on engaging children's participation in the design process in the Department of Design, School of Arts, Design and Architecture, Aalto University.

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# Abstract

In design, collaborative notions and design practices have expanded the type of users from adults to the younger generations. In line with this trajectory, children have become actively engaged as social actors and partners in research and design practices. There are two approaches which typify this; Participatory Design has involved children in environmental planning and design, whereas the Child-Computer Interaction community focuses on the domain of scientific research on the interaction between children as well as computational and communication technologies. Grounded particularly in Human-Computer Interaction research, *Cooperative Inquiry* has been introduced, applied and expanded in practice as a method of designing a technology working with both adults and children. Although children's participation and involvement have been acknowledged in research and design, the development has leaned toward environmental planning and design as well as computational and communicational technologies, rather than other domains. Moreover, design practitioners have continued to encounter difficulties in practices designing for and designing with children, since working with children requires a thorough understanding and knowledge of children's cognitive and physical development (i.e. dexterity, strength, motor skills and all developing significantly throughout childhood), as well as an adaptation of methodological matters. Furthermore, the imbalance of power relationships among stakeholders (children, educators, parents, experts in child development, designers and researchers) is considered.

The purpose of this research is to the communication and collaboration methods of adult designers (design practitioners) with children in the design process. This research has been framed by *experimental design research*. Through its own experiments (design practices), the research has developed research questions and responses through an analysis built upon the findings from each practice. The practices have focused on furniture and spatial design; however, the key findings and recommendations of this research have been inclusively engineered for general design practitioners and researchers working with children. During the empirical practices with children, I have attempted to explore the children's position, the approaches and procedures, as well

as the manners and tools supporting interaction and communication with children in the design process when designing *for* and *with* children. Based on these research questions, the objectives of this study are to understand the value of children's participation in design, to position the designer's role in designing *for* and *with* children, and to provide practical guidance for adult design practitioners and researchers working with children. This study ultimately aims to enhance the well-being of children through their participation and collaboration in both design and education.

I examine prominent research and design techniques associated with children in the literature review section. In juxtaposition to that, I describe relevant current research and position my research. Lozanovska and Xu have described children's participation in design as five different models, and I have adopted three of these models: *Design with children, Social scientist for children* and *Pedagogical* models, which have inspired in the constructing of the framework of this research. These models have been applied to my own practice and resulted as three models of practice: *Design* for *and* with *children, Social science for children* and *Tangible ideation* models. Based on investigations and findings through design practices applied with the models of practice, this research points out three principles: material matters; process and structure; as well as a framework within designing *for* and *with* children. As the main findings, this research introduces the double triangles which describe the relations among practitioners, products and practices between *designing for* and *designing with* children as a new framework of designing for and with children. Using these triangles, materials have been redefined as a medium during different interactions with and through materials; in addition, the roles of various stakeholders have been positioned in this structure of *Tangible ideation* practice.

My underlying argument begins with stakeholders' roles and children's participation in design, and then focuses on design practitioners' reflective roles and position in design. Here I emphasise reflection and the practical contributions of this research, as well as provide considerable guidance for adult designers or researchers who work with children. This research has mainly focused on seven- to twelve-year-old primary school-aged children in Finnish and Korean contexts. However, this study also suggests research possibilities with both younger and older children as well as other cultural contexts in further research.

# Preface

## The experience of working with children

Over the last 15 years, my affiliations and projects have switched several times between studying in academia and working in industry. Through many of these projects, I have designed a wide range of products for children, such as furniture, playgrounds, wearable toys, shoes, and small objects. I have worked as a designer in a development team, a manager in a design department, and eventually as a director in the research and design unit in two companies in South Korea. Furthermore, I have taught different aged children in arts, craft, and design in South Korea and Finland, as well as worked as a youth worker in the UK. Although I have shifted my affiliations between learning and working environments, I have constantly been concentrating on design and research concerning children. These experiences have strengthened my professional qualifications, designerly skills, as well as personal confidence, and finally led me into this doctoral research.

During these work experiences, as a design practitioner, I have felt stresses when creating new ideas to meet users' requirements and needs as well as when designing for a marginalised group of people. I assume that this difficulty is not one faced merely by me, but also a commonly shared experience with other design practitioners. Once I interviewed designers working for companies of children-related products and services in South Korea in early 2012. This interview was initially aimed at investigating designers' inspirational sources and development process, including techniques and approaches. The designers shared how their inspiration derived from literature, media, and people, or how they drew on their own experiences. From this investigation, I scrutinised the difficulties of creating new design ideas and the lack of confidence the designer felt in continuing the development procedures; these difficulties were due to their limited interactions with the users, namely children. Overall, many designers have expressed some distress when designing for children. Here are a few commentaries exemplifying designers' frustrations:

*"I do not know where to start."*
*"I have a lack of experience with children."*
*"I am not confident about proceeding with this idea."*
(ABL Memo 1, 2012)

As a design practitioner, I have been involved in various projects to develop furniture as well as educational and playful equipment for toddlers to pre-school aged children in South Korea from 2005 to 2007. Whilst I was working on these projects related to young children, several designers within the development unit, including myself, struggled with meeting the children's initial needs. We occasionally relied on suggestions and requirements from the children's parents, teachers and other experts in child development demain in the product initiatives. Moreover, we, the design practitioners often experienced an undermining of our roles and importance during the discussions with the associated adult stakeholders and internal personnel in the development process. The internal personnel did possess a background in education, and their profession is in child development; however, the power relationships in the working context between the personnel and design practitioners were inequitable. Therefore, I was concerned from the start whether the suggestions from the adult stakeholders would indeed fulfil the children's needs and requirements. Furthermore, due to the absence of a design practitioner's input in the development discussions, I had little faith in the development process and outcomes.

After I completed the Master of Arts in Furniture design programme in University of Art and Design Helsinki, Finland in 2009, I returned to work in the industry to focus on developing children's playgrounds and play equipment in South Korea. Through my Master's thesis work, I attempted to involve children in the design development process, and was convinced of the success of product development through their involvement. Afterwards, I ambitiously planned to implement this participatory approach in actual projects. This was a remarkable experience; however, it was not a simple procedure, and I faced challenges and limitations adapting this approach in practice. These difficulties will be further explained through three episodes from my experience, before moving forward into this research.

## Episode 1. Designer's misinterpretation

A decade ago, the Korean government initiated an extensive project, *SangSang Children's Park*, to renovate 1 063 old and decommissioned playgrounds in Seoul. The outcome was expected to provide spaces for play, social activities, and relaxation not only for children but also for the local communities. The project aimed to involve the residents, including children, in the development process. As a result, 304 playgrounds were renovated between March 2008 and May 2011. To design the space, there were several priorities: the requirement of green tracts of land for inferior and densely built-up areas; maintenance of a sufficient amount of play areas and equipment; and provision of shelters and community facilities. Our team enthusiastically participated in this project that would give children more play opportunities.

After the planning and construction, the outcomes were perceived to be satisfactorily achieved according to the feedback received from both the internal and external stakeholders. However, I felt that we lacked input from the users, particularly the children, who had been involved and shared their opinions at an early stage of the development process. Hence, it was relevant to plan fieldwork to investigate the children's feedback on the project's outcomes.

During the fieldwork, we observed that the playground was often unoccupied by children. The purported reason was that children were allowed less free time to play outside, due to extended school days and other educational activities in South Korea (Nah, 2017). One day, I visited one of the playgrounds designed and constructed by our team. The play area had plenty of play equipment, such as seesaws, slides, and swings. We luckily observed some children playing in the space. However, I watched one boy who, after only spending a couple of minutes there, already seemed ready to leave and move on. I speculated about his reasons for wanting to leave the playground and decided to approach him and ask. According to his answer, although the play area had plenty of play equipment, it was a boring place; therefore, he was moving on to other playgrounds which he thought more fun. I requested and received permission to follow this boy to another playground and observed his playing. Surprisingly, that play environment consisted of merely

a house-type play sculpture connected with wooden bridges rather than standard play equipment.

Nonetheless, it was spacious; therefore, the children could freely run in it. On the site, I met another two boys playing, and they explained that this playground could be much fun since they could create games and use the space according to their imaginations .For example, they mentioned that the house was the right place for a game of hide and seek.

Based on this field research, I critically concluded that us adults had missed or misinterpreted some fundamental notions about children's play and interests. Offering space and time to play imaginatively is of prime importance to children rather than providing readymade play equipment. Furthermore, free-play and exploration provides children with a sufficient degree of challenge and motivation. Finally, there are several practical reasons why those designing products or services for children have little understanding about their end-users, children: a lack of time, the workload, limited chances to meet children, or insufficient experience to utilise relevant techniques and skills to communicate with children.

Based on the investigation and challenges faced, I have listed several uncertainties experienced by designers in the midst of designing any artefacts for children: 1) children's satisfaction with the current products or services for children, 2) adult designers' challenges when designing *for* children, and 3) adult designers' understanding of children's needs and wishes as well as communication with children in the design process. Some of the concerns are too general or broad to be encompassed in this research. However, these concerns could be seeds to sharpen focus and develop research questions for further study.

## Episode 2. Function follows form

In 2009, whilst I was undertaking my Master's thesis research (Lee, 2009), I conducted *My furniture* workshop with seven- to nine-year-old children in Helsinki, Finland. I provided the participants with fabricated materials, such as art and craft supplies, ready-made or found objects, or recycled materials with which to design their furniture and space. The children were expected to build furniture with

the materials provided. This workshop initially aimed to investigate children's notion about furniture and space; however, this workshop resulted in converting the norm between forms and the functions of objects through children's perspectives.

Louis Sullivan's principle, *Form follows function*, is one of the most well-known principles in contemporary architecture and design. This notion has enhanced functionality in minimalism. Contrastively, the children participating in the workshop conveyed that *function followed form* with their output during the workshop. For instance, several children selected the ready-made or found objects and created functions of furniture and space based on the shape of the objects, such as the high legs of bed and stairs out of plastic bottle tops (**Image 1**).

IMAGE 1. A model of furniture and space built by a child in My furniture project.

The form of objects may trigger children to generate new ideas rather than creating forms according to their functions which may be intellectually more challenging for children than adults.

The use of *found objects* (e.g. bottles, tubes, sheets) for re-purposing is a common activity for both adults and children; however, this workshop was essentially organised by bringing the idea, *Function Follows*

*Form*, into practice. From the workshop, I have listed a few interests in terms of distinctive perspectives designers have adopted when working with children: 1) children's articulation of their thoughts and feelings, 2) usage of ready-made objects and fabricated materials, and 3) distinctive merits from two-dimensional to threedimensional working processes versus from three-dimensional to two-dimensional working processes working with children.

Later, when I started my doctoral research, I undertook a case on children's designerly and architectural activities. From this study, I investigated new relations between forms and functions through the young participants' outputs. These findings are discussed in detail in Chapters 3 and 5 in this dissertation.

## Episode 3. I am not good at drawing

In the summer of 2012, I regularly spent time with a seven-year-old girl, Soo-jin, a child of a friend, in arts and craft activities once a week for five months. At the time, she lacked much experience in arts and craft activities. One day, she told me that a horse was her favourite animal. I suggested that she drew it on the paper and then created a small paper model based on the drawing. However, she instantly replied that she was not good at drawing. Whilst we were drawing and building the model, she occasionally expressed little confidence in her drawing ability. Nevertheless, she demonstrated an average level of drawing skills for a child of her age.

This conversation challenged my assumption that children were innately able to draw and explain their thoughts through drawings, rather than verbal or written expression. On the 16th of May 2017, I had a reflective discussion with Jack Whalen, who was one of the advisors of my doctoral research at the Department of Design, School of Arts, Design and Architecture at Aalto University. Based on the reflective discussion with him, a child's confidence in drawing might rely on the inquiries provided, such as the questions asked, the encouragement given, the sources available to a child, or a child's available capabilities. Drawing a specific figure may require advanced techniques or at least extensive trained experience in drawing.

The above was not the only moment that I had heard this type of comment from children. Mainly when working with children less confident in the drawing, I realised that some other approach would be needed to carry out the activity with the child. Therefore, I provided the child with ready-made or found objects to construct her idea. As a result, we formed the shape of a horse out of toilet paper tubes, cereal boxes, ice-cream boxes and milk boxes (**Image 2**) rather than working on a drawing.


Image 2. A model of a horse made out of recycled materials (e.g. toilet paper tube, cereal boxes, ice cream boxes, and milk boxes).

I have listed my assumptions (hypotheses) related to children's drawing: 1) If there is an alternative approach, it will support children to express and embody their thoughts, and 2) tangible materials could encourage children more swiftly and effectively to articulate their ideas.

## Short summary

These uncertainties as mentioned earlier, interests and assumptions acted as a guide to construct my research questions and foci of this research. Through my practices of working with children as a design practitioner, I have answered them during the doctoral research journey in this dissertation.

**Uncertainties experienced by designers in the midst of designing any artefacts for children:**

1. Children's satisfaction with current products or services for children,
2. Adult designers' challenges when designing *for* children, and
3. Adult designers' understanding of children's needs and wishes as well as communication with children in the design process.

**Interests regarding unique perspectives designers have adopted when working with children:**

1. Children's articulation of their thoughts and feelings,
2. Usage of ready-made objects and fabricated materials, and
3. Distinctive merits from two-dimensional to three-dimensional working processes versus from three-dimensional to two-dimensional working processes when working with children.

**Assumptions (hypotheses) related to children's ideation and expression by drawing:**

1. If there is an alternative approach, it will support children to express and embody their thoughts, and
2. Tangible materials could encourage children to better articulate their ideas.

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# The list of abbreviation

| | |
|---|---|
| ABL | Archive of Bang Jeon Lee |
| ARKKI | *Lasten ja nuorten arkkitehtuurikoulu*, School of Architecture for Children and Youth |
| CCD | Child-Centred Design |
| CCI | Child-Computer Interaction |
| CCR | Child-Centred Research |
| FNAE | Finnish National Agency for Education, Opetushallitus |
| HCD | Human-Centred Design |
| HCI | Human-Computer Interaction |
| IDC | Interaction Design and Children |
| PD | Participatory Design |
| UCD | User-Centred Design |
| UID | User-Inspired Design |
| UNCRC | The United Nation Convention of the Rights of the Child |

# Introduction

Over the last four decades, citizens have transitioned in their roles becoming more active participants in their society (Sanders, 2003). In accordance with this active involvement, collaborative notions and practices have extended from adults to the younger generations (Druin, 1999). Children have been extensively studied in childhood, development, education, pedagogy, sociology and psychology (Piaget, 1970; Vygotsky, 1978; Montessori, 1994, 2004). More recently, children have been actively engaged as social actors and partners for adults (Greig, Taylor, & MacKay, 2013; O'Reilly, Ronzomi, & Dogna, 2013; Christensen & James, 2008) and their involvement has stretched into design practices (Druin, 1999; Pardo, Vetere, & Howard, 2005). Hence, increasing attention has been paid to enabling children's voices (Ghaziani, 2008) to be heard, and to encouraging their participation in society (Tonucci & Rissotto, 2001; Matthews, 2001; Hussain, 2010). Ever since children have been actively involved and their contributions acknowledged in research and design, their roles have been defined according to various approaches and the nature of the children's contributions (Scaife, Roger, Aldrich, & Davies, 1997; Druin, 1999; Kelly, Mazzone, Horton, & Read, 2006; Lozanovska & Xu, 2013). In addition, current IDC/CCI communities have also paid attention to the new roles of children in design (Barendregt *et al*., 2016; Iversen, Smith & Dindler, 2016; Kinnula *et al*., 2018).

Two remarkable organisations have concentrated on designing with children in the USA and UK. Led by Dr. Allison Druin, the Human-Computer Interaction Lab at the University of Maryland has created Kidstream to focus on developing technology with both children and adults collaboratively working as design partners (http://hcil.umd.edu/children-as-designpartners/). Accordingly, as adopted from the *Cooperative Inquiry* method of design (Druin, 1999), *Kidstream* concentrates on building technologies that are relevant to children's interests and needs with intergenerational design teams. The other organisation, Northumbria University in the UK, pursues on-going research and operates a website, *Designing with Children*, which aims at inspiring design practitioners and associated professionals who are enthusiastic about exploring the ways children's cultures,

capacities and imagination influence the design profession, design process and built environment (www.designingwithchildren.net). Based on the introduction to methods of designing with children by Druin (1999), *Cooperative Inquiry* is grounded in Human-Computer Interaction (HCI) research, and this combines theories of cooperative design, participatory design, contextual inquiry, activity theory and situated action (Druin *et al*., 1999). Inspired by HCI, Child-Computer Interaction (CCI), namely Interaction Design and Children (IDC) community, focuses on the domain of scientific research on the interaction between children as well as computational and communication technologies (Read & Markopoulos, 2013). In particular, the community aims at designing to support children's development, enabling cognition to action, movementbased simulations, and re-enactments of motor-perceptual statues (ibid.). Moreover, Antle (2013) highlights adapting existing skills and abilities, as well as developing them to enable learning and development in CCI research. According to the foci on IDC and CCI communities, designing for and designing with children have emphasised distinctive perspectives: product-oriented which focuses on developing computational products and services for children, and *process-oriented* which focuses on the involvement of children in the design process (Iversen, 2005, p.15). I will explain these in details in Chapter 2.

Within this community, many scholars have addressed the various merits of children's participation both in child development as well as design theories and practices. Starting from User-Centred Design (UCD), Hanna, Risden, Czerwinski, and Alexander (1999) argued for usability research with children designing for them. In addition, Pardo, Vetere and Howard (2005), as well as Kelly, Mazzone, Horton, and Read (2006) addressed the extensive involvement of stakeholders, including children, during the design process. Although, there were attempts to involve children in UCD practices, their participation was far limited.

However, these existing approaches have focused on developing technology and computational works. Moreover, these methods and techniques have been applied to architectural and spatial practices; therefore, there are gaps in earlier research that could be filled, such as the need to balance power relations among participants, and to emphasise

the roles of adult designers and researchers. The main contrast with the earlier research is that they have focused on children-designed solutions in artefacts employed in/via technology and technological contexts, whereas this research focuses on artefacts that are tangible, and designed for small hands.

Several researchers have addressed the value of user participation in design. User participation improves both the quality of the product (Grudin, 1991; Grønbæk *et al*., 1993) as well as the quality of the process (Bødker *et al*., 1987). To focus on participation in design, Scandinavian Participatory Design (PD) has invited different stakeholders from distinctive backgrounds to improve their working environment since the 1970s (Ehn & Kyng, 1991). PD has emphasised the partnership between users and researchers from different disciplines. Participatory approaches require active user involvement; in other words, designers provide users with more central roles by inviting them into the design phase (Scaife *et al*., 1997). According to the studies of PD (Namioka & Schuler, 1990; & Kyng, 1991a; Clement & Van den Besselaar, 1993; Schuler & Namioka, 1993; Simonsen & Robertson, 2012), there are five fundamental aspects: politics, user, context, methods and products. PD is influenced by HCI; however, these are distinctly different in practices and outcomes. PD emphasises design practice, the actual 'doing' of design practice, rather than focusing on the resultant outcomes, such as products and service. Consequently, this feature of PD differs from the focus of HCI, including CCI (Simonsen & Robertson, 2012).

To overcome the limits of children's involvement in UCD practices, PD gives possibilities for uncovering how to design *with* and *for* children. For instance, Druin's Cooperative Inquiry has pointed out the remarkable involvement of intergenerational children as design partners during an entire design process (Druin, 1999; Druin *et al*., 1999). Globally, children have actively engaged in environmental planning and design (Driskell, 2002; Matthew, 2001; Tonucci & Rissotto, 2001; Baek & Lee, 2008; Parnell, Cave, & Torrington, 2008; Lozanovska & Xu, 2013).

The impact of the participatory approach has spread to diverse domains involving children, in addition to their education. School fundamentally aims to support pupils' physical and mental development

from childhood to adulthood, in order to become an ethically responsible member of society. According to this principle, the Finnish National Agency for Education (FNAE) has claimed that the school system has to support equality, parity and justice. In addition, a culture of activity and context aim at supporting learning, participation, well-being and a sustainable lifestyle (Finnish National Agency for Education [FNAE], 2014; Piirainen, Sarkola & Westerlund, 2012). During this current period, the school curriculum has been rapidly changing in many countries. One example of this change is the inclusion of real-life problem-solving exercises (Eggleston, 1976). This type of exercise is also prevalent in design research and practice. Hence, design could tackle real context practices in children's education.

To focus on Finnish education, the school has emphasised *Active learning* as one of the primary teaching and learning methods. *Active learning* is "a method of learning in which students are actively or experientially involved in the learning process and where there are different levels of active learning, depending on student involvement." (Weltman, 2007, p. 20). The Finnish education system has included the use of cross-disciplinary learning and teaching in school, and this new pedagogy has been globally spotlighted (FNAE, 2014). This new system emphasises phenomenon-based learning and collaborative classroom practices, both of which are also one of the core principles of design research and practices. Hence, the design has been implemented both nationally and internationally in the primary school curriculum.

Echoing the cross-disciplinary learning and teaching in Finnish schools, Korean education has emphasised an integrated curriculum and hands-on activity enhancing creativity, targeting in particular the lower grades (first to third graders) in primary schools (Lee *et al*., 2015). In other words, the lower graders have only studied a few subjects, such as *Ba-reon-saeng-hwal*, *Seol-gi-ro-un-saeng-hwal* and *Jeol-geo-un-saeng-hwal*, which are based on the integrated curriculum. These subjects have been designed to integrate into other two subjects within eight common categories: school, spring, family, summer, community, autumn, country and winter. First, *Ba-reon-saeng-hwal* focuses on learning a fundamental attitude for everyday living and studying. It enhances community capability, selfmanagement capability and communication capability. Secondly, *Seol-gi-ro-un-saeng-hwal*

concentrates on learning about acquiring continuous interests in the surroundings and world, various phenomena and relationships of society and nature, as well as logical thinking and active reactions to changes based on exploration. This subject focuses on creative thinking capability, knowledge information management capability and communication capability. Lastly, *Jeol-geo-un-saeng-hwal* focuses on learning about necessary expression capability and cultural knowledge through artistic experience and physical activities. It concentrates on aesthetic and emotional capability, creative thinking capability and communication capability (ibid.).

In addition to child educational and pedagogical inspiration, this research has been influenced by the Montessori approach, which is a well-known philosophy in child education instigated by Maria Montessori in 1906. This approach encourages harnessing the materials available in the surrounding environment to promote learning through hands-on-activities (Montessori, 1994, 2004). Initiating from the FabLearn Labs (formerly *FabLab@School*, https://tltl.stanford.edu/project/fablearn-labs) at Stanford University to *FabLab@School* (https://fablabatschool.dk) at Aarhus University, there is a trajectory of the emergence of children's education and design. Design-based learning for the school context has been actively conducted and has explored the tools supporting children's learning in the CCI domain (Bekker *et al*., 2015; Smith & Iversen, 2015; Eriksson *et al*., 2018). Both *FabLearn Labs* and *FabLab* emphasise collaboration and creative problem-solving within a hands-on working environment, and these principles have been similarly applied to primary and lower secondary schools. In line with the importance of materials in child education, the meaning of materials has been defined and expanded in design. Designers have attempted to explore new materials and improve the finishing qualities of products applied to particular materials. Nonetheless, beyond exploring new materials and improving the final attributes of products, the meaning of materials has expanded its boundaries to other domains, such as data, information, toolkits, techniques, and others depending on different contexts and situations. Many scholars have discussed various aspects of materials in design research, such as Ehn and Kyng's Cardboard computers (1999), Mattelmäki's Design Probes (2007), Eriksen's Material Matters in Co-design (2012) as well as Sanders and Stappers' Convivial toolbox (2013).

As mentioned earlier, despite the acknowledgement of children's participation and involvement in research and design, in particular CCI and PD with children, development has leaned toward computational and communication technologies as well as environmental planning and design. Indeed, design practitioners have continued to face difficulties in practices designing *for* and *with* children due to the complex nature of working with children. In addition, existing design and research methods focusing on working with children are incongruent with different contexts and settings. Furthermore, this imbalance of power relationships among stakeholders needs to be considered. I mentioned at the beginning of this dissertation that this research initiative started from a research question on examining the ways an adult designer (design practitioner) communicates and collaborates with children during the design process. During the entire research journey, I have pondered the answer to three sub-research questions focusing on mutual learning between me, as a design practitioner, and children through experimental practices. Consequently, this study focuses on exploiting an adult designer's positions and roles in designing *for* and *with* children.

**RQ: How do adult designers (design practitioners) communicate and collaborate with children in the design process? What are the best positions and roles of adults in designing *for* and *with* children?**

**SQ1. How do adult designers (design practitioners) understand children's position and their roles in the design process?**

**SQ2. What kind of approach and procedure should be used when designing for and with children?**

**SQ3. What are the manners and tools that enhance interaction and communication with children in the design process?**

Based on the above research questions, the objects of this study are three-fold: 1) to understand the value of children's participation in design, 2) to position the designer's role in designing *for* and *with* children, and 3) to provide practical guidance for adults (design practitioners and researchers) working with children. The primary audience of this research is professional designers and academic faculty working

with children. Primary school teachers and educational experts are my secondary audience.

Most importantly, this research aims at augmenting the well-being of children initiating from children's participation and collaboration. According to Article 1 of The United Nations Convention on the Rights of the Child (1989), it states that a young person below the age of 18 years is defined as a child. Within the 31 articles, the rights of the child have been addressed from different aspects concerning a child's freedom, education, development and well-being (The United Nations Convention on the Right of the Child [UNCRC], 1989). Focusing on the scope of this study, I have paid attention to the five articles (12, 13, 28, 29 and 31, attached in the Appendices), which have addressed the right for a child to freely express oneself to receive an education, to develop and play. This research has been mainly conducted with seven- to twelve-year-old primary school children in Finnish and Korean contexts. However, this study does not exclude research possibilities in other directions with younger children and teenagers as well as different cultural contexts.

I have adopted an ethical stance throughout the different phases of this research: when designing the research plan, conducting the practices, as well as reflecting on the findings. Based on the ethics in the context of PD, I have paid attention to the ethics in research and designing for and with children. These ethical concerns support the needs and foci of my research and guide in answering the research questions designing *for* and *with* children.

Due to the inappropriateness of the existing methods, this research has been framed by experimental design research (Sanders & Binder, 2007). This study is designed to explore an iterative approach in designing *for* and *with* children to focus on the materials and structure of design activities with them, but also to provide a new framework through design practices. Based on the experiments, namely design practices, the research questions have evolved and answered building upon each question. Inspired by the concept of FabLabs in education, engagement and creativity in learning through making (Giannakos & Divitini, 2016), this research strengthens its position by building on the fundamental experience of materials as substances, and learning through materials, which have been developed with children, as well as integrated into their comprehensive education.

**In this research, I have conducted eight cases:**

· Case 1 *Månen*:
  Formulating the initiative process between designing *for* and *with* children
· Case 2 *ARKKI observation*:
  Demonstrating an initial understanding of children through observational studies in the indoor environment
· Case 3 *Hut-building*:
  Demonstrating a deep understanding of children through observational studies in the outdoor environment
· Case 4 *Organic architecture*:
  Conducting initial phase of a material study and implementation with children in ARKKI
· Case 5 *Dream park*:
  Conducting the initial material study and implementation with 5th-grade pupils in a Finnish primary school
· Case 6 *Build my city, Helsinki*:
  Conducting the advanced material study and applying the material study toolkits for children with 5th-grade pupils in a Finnish primary school
· Case 7 *Build my city, Seoul*:
  Conducting the advanced material study and applying the material study toolkits for 5th-grade pupils in a Korean primary school
· Case 8 *Build my space*:
  Conducting the advanced material study and implementing the material study toolkits for 2nd-grade pupils in a Korean primary school

Except for Månen Practice in Bergen, Norway, the other cases were conducted mainly in locations in Helsinki, Finland, as well as Seoul and Cheongju in South Korea from 2012 to 2014. In this study, I have adopted Lozanovska and Xu's (2013) three models of practice: 1) *Design with children*; 2) *Social scientists for children*; and 3) *Pedagogical* models. By adopting the Design with children model, Case 1 *Månen* formulates the initiative process and focus of this research. I

describe and refine the notion between *designing for* and *designing with* by illustrating it with two triangles. The second model, *Social Scientists for Children* model is applied to demonstrate the research and design techniques, thereby enhancing a deep understanding of children in the observational studies on children's indoor and outdoor activities through Cases *2 ARKKI observation* and Case 3 *Hut-building*. Adopted from the *Pedagogical* model, Cases 4 to 8 focus on the design practices of material exploration and implementation with school-aged children in Finland and South Korea.

Chapter 1 presents the meaning of designing with children in this research. Mainly in the literature review section, this study surveys various research and design techniques of PD, as well as associated knowledge about children and practices of working with them. As *experimental design research*, I suggest a new framework of designing *for* and *with* children based on three adopted and elaborated approaches by Lozanovska and Xu (2013). Chapter 2 presents Case 1 *Månen*, which starts the focus of this research. Chapter 3 demonstrates a deep understanding of children through the observational studies through both Case 2 *ARKKI observation* and Case 3 *Hut-building*. Based on these investigations and findings, Chapter 4 represents a *material study approach and toolkits* for children through five cases. Most importantly, Chapter 5 presents three key foci in this research: material matters, process and structure, as well as a framework in designing *for* and *with* children. In Chapter 6, the primary argument starts with stakeholders' roles and children's participation in design; afterwards, this research focuses on adult designers' roles and position. Finally, Chapter 7 elaborates on the three models of practice: *Design* for *and* with *children*, *Social science for children* and *Tangible ideation* through the experimental practices in this study, providing considerable guidance for adults who work with children as well as emphasising the reflective approach and contribution of this research.

# 1.1 Literature review

Since the 1970s, the partnership has been on-going between users and experts (designers or researchers) from different disciplines in Scandinavian cooperative work (Namioka & Schuler, 1990; Greenbaum & Kyng, 1991a; Clement & van den Besselaar, 1993; Schuler & Namioka, 1993; Simonsen & Robertson, 2012). Designers and researchers have employed these approaches and practices in diverse works, in particular, Human-Computer Interaction (HCI). To extend users' involvement from adults to the younger generation, Participatory Design (PD) has been applied as a principle in design research and practices for and with children, Interaction Design and Children (IDC) and Child-Computer Interaction (CCI) have in particular been derived from HCI and focused on children as well as architectural and environmental design.

In PD, there has been a provocative debate about two particular issues: the best way and time to involve users in the design process, as well as the roles between designers and other stakeholders. Regarding the latter point, designers' roles have changed since users became more actively involved in the design process; however, I sincerely argue that the designer's profession should be retained, although users would be regarded as codesigners. Consequently, compared with the past, designers have not lost their distinct roles, whereas they need to reposition their roles according to the nature of the project in which they are involved. In this section, I review previous research focusing on design principles and techniques concerning children. Starting with UCD and then focusing specifically on Child-Centred Design (CCD), I concentrate on PD with children, in particular, the participation of children and adults in design. Reflecting on works mentioned early in the literature review, I have elaborated on and formulated specific foci:

- The current research in IDC/CCI and PD contributing to an understanding of the children's engagement in the design process;
- The approach and procedures suggested in current IDC/CCI and PD research to overcome challenges when designing for and with children; and
- The manners and tools proposed in current IDC/CCI and PD literature that enhance interaction and communication with children in the design process.

## Research focused on children in design

Children have been extensively studied for many years in childhood studies as well as child education, pedagogy, development, sociology and psychology. Until four decades ago, children were merely subjects of research; therefore, they have rarely had the opportunity to 'have a say', even 'have a voice' themselves in research. Literally, 'say' as a noun refers to the right to give an opinion about something (http://dictionary.cambridge.org/dictionary/english/say#british-1-3-1). Distinctive methodologies and techniques in research with children have been introduced; Children-Centred Research (CCR) is one of theprominent approaches focusing on children in research. In CCR, informal and hands-on techniques, such as photographs, diaries, and indepth interviews have been commonly applied, rather than traditional observation and structured interviews in a lab setting (Barker & Weller, 2003).

Regarding children's transformative roles from being the subjects of study to research partners, their roles have also transitioned in the research context (Greig et al., 2013; O'Reilly et al., 2013; Christensen & James, 2008). To focus on design, CCD regards the child as an end-user and commits to the primacy of the end user's characteristics and needs in design (Kelly et al., 2006). CCD emphasises supporting collaboration and partnership between child and designer, as well as the designers' task of working with children at different stages of the development process (Pardo et al., 2005). Druin (1999) addressed children's four different roles as a user, informant, tester and design partner in the design process. First, the child is a user: it is a minor participatory role since children's inputs are gathered when the product has been released to inform future developments. Secondly, the child is a tester: the tester evaluates prototypes of the products at early and/or later stages of the design. The test provides designers with the opportunities to invest children's feedback into the product before completing the development of the products. Thirdly, the child is an informant: children's desired ideas are taken on board at the early stages of the design concept creation. Lastly, the child is a design partner: children are involved as members of the design team who decide and share ideas with the adult designers (ibid., Druin et al., 1999).

Therefore, the children's involvement in the design process is regarded as a key principle.

Based on the changing of users' roles in Human-Centred Design (HCD) revolutions (Sanders, 2003), children's notable roles could be positioned between users and participants. Traditionally, a user-centred approach has included user involvement for the testing and evaluation of its functionalities. However, Gould and Lewis (1985) have emphasised that an early focus on the users reveals more active user involvement, which is an essential principle for a participatory approach. In other words, designers provide users with a more central role by involving and engaging them in the design process (Scaife, Roger, Aldrich, & Davies, 1997). Current design and research focusing on children indicate that the role of children has expanded to them becoming co-creators; however, this needs further and extensive study in comparison to the extended research already existing on adult stakeholders' roles as co-creator. Furthermore, children's roles have evolved and been clarified both in design and research practices (**Figure 1**).

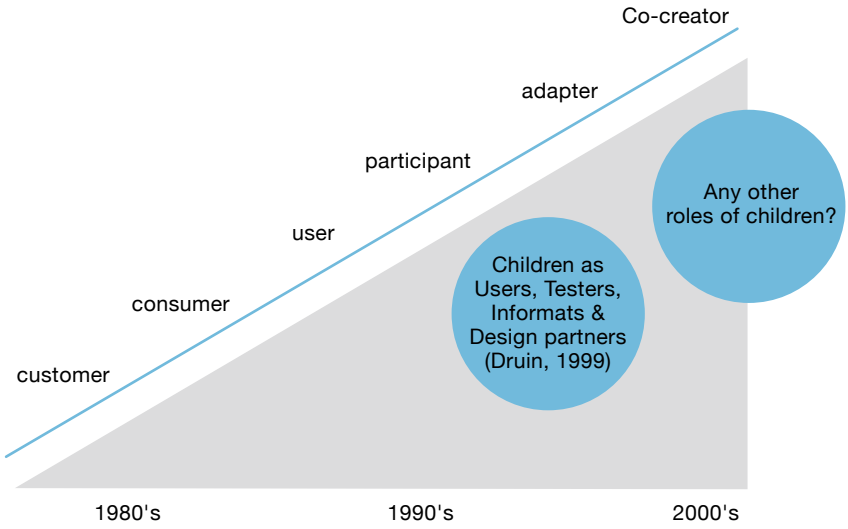



Figure 1. Changing the roles of children in design (and social science) elaborated from 'Human-Centred Design revolution' by Sanders (2003).

To focus on children's involvement in the design process, Kelly and her colleagues (2006) have suggested guidelines for working with children in child-centred product development. They have pointed out four distinctive aspects: 1) using familiar contexts, 2) reminding chil-

dren of the previous activities, 3) expressing ideas through familiar means, and 4) collecting ideas in different formats. The guidance has been provided for a later stage of the design process; however, these four aspects should be considered when designing any activities and scenes with children.

IDC/CCI is a specific domain of researching the interaction between children as well as computational and communication technologies (Read & Markopoulos, 2013). Primarily inspired by HCI, this requires multi-disciplinary information and supports a field of research and practice focusing on designing an interactive system for children. In addition, Read and Bekker (2011) have defined IDC/CCI as the study of the "Activities, Behaviours, Concerns" and "Abilities of Children" as they interact with computer technologies, often with the intervention of others (adults) in situation that they partially control and regulate (Read & Bekker 2011, p.163-170). IDC/CCI community defines their design research objectives as the following: 1) designing to support children's development, 2) enabling cognition to action, and 3) supporting movement-based simulations or re-enactments of motor-perceptual statues (ibid.). Another perspective of IDC/CCI as presented by Antle (2013) is that research should design differently to support existing skills and abilities to enable usable products, as well as to augment developing skills and abilities to allow learning and development.

## Beyond Cooperative Inquiry

As earlier mentioned, grounded in HCI, Cooperative Inquiry has been inspired by research and theories with cooperative design, participatory design, contextual inquiry, activity theory and situated design (Guha, Druin, & Fails, 2013; Druin, 1999; Druin et al., 1999). In comparison with the previous methods, Cooperative Inquiry supports techniques applied by an intergenerational group working with adults and children collaboratively throughout the design process. In this approach, design includes all of the works from start to finish in creating technology; therefore, it constitutes brainstorming, coding, building, iterating and testing (Guha, Druin, & Fails, 2013). Cooperative inquiry applies to various tangible design techniques: Bags of Stuff

and large sheets of paper to prototype; sticky notes to critiques; journals, video, and white-board discussions to reflect; as well as role-playing for problemsolving (ibid.). These techniques should be implemented into the activities and inquiries with children according to their cognitive development and research contexts. **Table 1** presents the techniques in Cooperative Inquiry according to the different stages.

Table 1. The different techniques in *Cooperative Inquiry* (Guha, Druin & Fails, 2013).

| STAGE | TECHNIQUES | DESCRIPTION | CONSIDERATION |
|---|---|---|---|
| Any | *Observation* | This is useful for long-term use of technology. | This is time-consuming. |
| Prototyping | *Bags of Stuff* | This is one of the oldest cooperative design methods used in Scandinavian countries. | It is a useful practice to break into small groups (2~3 children + 1 adult) when creating low-tech prototypes since the process of sharing ideas is more structured. Tailoring the materials should be considered on some occasions. |
| Brainstorming | *Large paper to prototyping* | This allows numerous design partners to gather to work on one idea collaboratively. | The 2-dimensional brainstorming techniques have been useful when working on screen-based interfaces. |
| | *Layered Elaboration* | Add ideas without "destroying" the original ideas.<br>Design partners create or are provided with a base design on which to elaborate and iterate. | Each small group elaborates on the original design, and a sheet of clear acetate is laid over the original design. |
| | *Mixing Ideas* | This is a new *Cooperative Inquiry* technique that each team member begins with an idea and follows step-by-step of combining the ideas into one large plan. | This supports the fragile egos of young children and helps them see their influence on the final product and build cohesion in the team. |
| Critiques | *Sticky notes* | This is useful for critiquing an existing technology or prototype of a new one (e.g. like, dislike, design idea). | An adult researcher collects and places the written notes on a large wall space. Also then, these notes are categorised. |
| Reflection | *Journals, videos, white-board discussion* | Note-taker writes down the ideas (that are surprising, most repeated among groups, or ideas that receive the most reaction from the whole team) and the team discusses these ideas and decides which to pursue. | Adults help children to clarify ideas and continue the elaborative creative process. If a child chooses to draw, an adult team member sitting with that child, and with his/her permission, annotates the drawn reflections in writing to provide clarification for later analysis. |
| Problem solving | *Role-playing* | Based on the natural play of children, role-play can be used for problem-solving. | Depending on children's cognitive development, role-playing should be assigned. |

As explained and depicted by Table 1 above, Cooperative Inquiry has introduced various techniques working with children to design, including conceive, develop and produce a new technology. These have been implemented based on contexts of products and design inquiries in different design stages. Hence, these techniques need elaboration to be performed in designing other artefacts. Furthermore, some of the methods should be tailored to the age of the children and the specific design inquiries. Although the introduced techniques have been developed focusing on a different stage of design process, these were appropriate for working with a small number of groups, including child partners and adult researchers. In addition, the techniques have been applied in controlled settings, usually in research rooms rather than children's environment. However, I bring these up in contexts in which a wide range of children could participate. Additionally, I examine the validity of the techniques in ordinary schools, which have fewer resources, such as supplies and adults supports, compared with Kidstream research teams.

## Participatory Design with Children

HCI has inspired PD; however, there are some distinctions between PD and HCI. PD emphasises design practice, rather than focusing on the resultant outcomes, both products and service. Both approaches emphasise the practices; however, the primary distinctions are that HCI focuses on the content of the practices and implications for design. In contrast, PD focuses on the actual 'doing' of design practices (Simonsen & Robertson, 2012). During the learning process, the practices of design are composed of various design activities. These included the innate need to provide means for participants, the need for respect for different voices, engagement of the working atmosphere, as well as the need for improvisation and on-going evaluation throughout the design process (ibid.).

Initially, Halskov and Hansen (2015) have described the five fundamental aspects of PD: politics, people, context, method and product, and these aspects have been proved according to the studies of PD researchers, such as Namioka & Schuler (1990); Greenbaum & Kyng (1991a); Clement & van den Besselaar (1993); Schuler & Namioka

(1993); and Simonsen & Robertson (2012). In PD, it is vital to ponder and understand the definitions of participation and its practices. There are several aspects to define participation: participants, types, degrees, durations, and areas of participation.

Halskov and Hansen's (2015) review highlighted a lack of new and burgeoning areas for PD with children up to 2012. Nevertheless, various practices for working with children have immensely increased since then. Notably, the IDC conference strongly focuses on issues of empowerment and ethics in working with children and this has been extended into IDC/CCI communities.

Halskov and Hansen (ibid.) have elaborated on these five features and principles of PD focusing on working with children. First, children have a right to be heard and participate. According to the United Nation Convention on the Rights of the Child (UNCRC, 1989), all children should retain their right to be involved and the relevant articles on the rights of a child. Secondly, children are experts in their own lives. They have their perspectives; therefore, they know more about their lives than anyone else. Thirdly, the actual situation related to children is a starting point. They can be aware of the real situation, but the case should be somehow familiar to them. Hence, the situation should be balanced between feasibility and familiarity. Children may lose their motivation when engaging in projects too far removed from their own lives and circumstances. Fourthly, the methods should be elaborated based on individual requirements for children. The application of techniques is occasionally adapted from the adults' perspectives, rather than being child-centred. Finally, the design alternatives from PD are for improving children's quality of life and well-being (ibid.).

In addition to Sanoff's (2007) characteristics of PD projects, Halskov and Hansen (ibid.) have defined the characteristics of PD projects with children, such as design ideas, working environment, and children's contribution to design decisions. Design ideas arise during the collaboration with children, and designers should spend time with children in their environment, rather than laboratory situations. Finally, children receive real opportunities for influencing design decisions (ibid.). The definitions could be an initial guidance and framework to conduct a PD project with children, as well as connecting to the research objectives and approaches in this study.

## Children's participation in design

To focus on children's participation in design, their roles have been emphasised in several researchers' previous works. Although Druin and her colleagues focused on collaborative work with children suggesting equality between children and adults (Druin, 1999), children's participation has been rather limited; for instance, children have not been involved in problem definition but solely in finding solutions. Scaife and his colleagues have underlined children's roles as informants in their design work (1997, 1998). However, children have occasionally acted in multiple roles, such as being something between informants and design partners (Read et al., 2005). To reiterate, children's participation has been highlighted but restricted. It is required to consider the best way and time to involve not only children but also distinctive stakeholders in the development process.

Hussain (2010) categorised different levels of participation, and the roles of children and adults based on their respective participation. There are three levels of involvement. First, the included level is when adults consult the projects, and children are merely observed whilst testing products, prototypes, or services and asked questions. Therefore, they have few opportunities to express their needs and desires. Secondly, the consulted level is when adult designers attempt to find ways for children to express their perspectives according to their culture and level of development. They ask children about their needs and desires; however, they are indirectly included in the design process. Finally, the empowered level is when adult designers try to seek and understand children's opportunities to influence the design of their own products and services. Children simultaneously learn design skills and participate in developing new solutions (ibid.).

Due to the critical review, Lozanovska and Xu (2013) have first described children's participation in design as four different models: *Children's voice* (**Figure 2**), *Design by children* (**Figure 3**), *Social scientists for children* (**Figure 4**), and *Design with children models* (**Figure 5**).

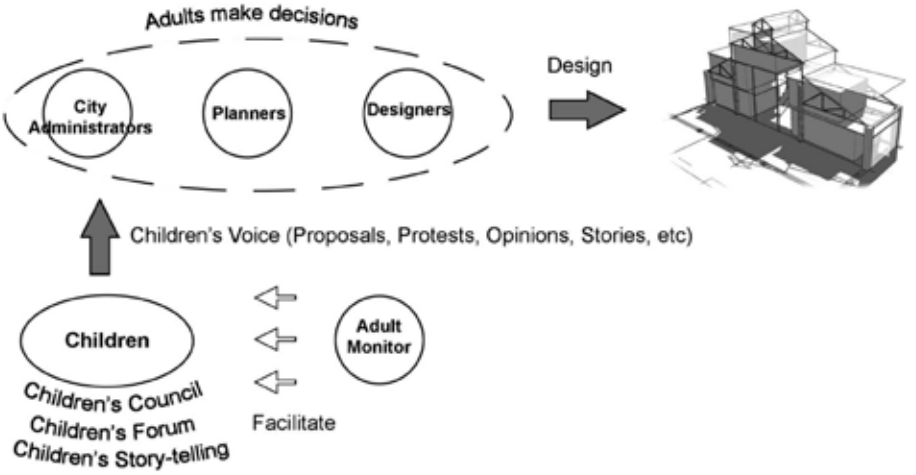



Figure 2. The *Children's voice* model (Lozanovska & Xu, 2013).

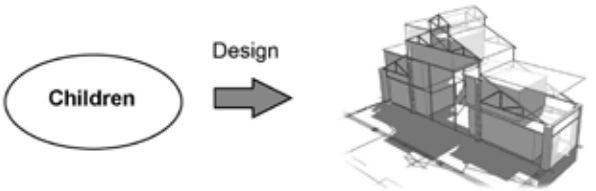



Figure 3. The *Design by children* model (Lozanovska & Xu, 2013).

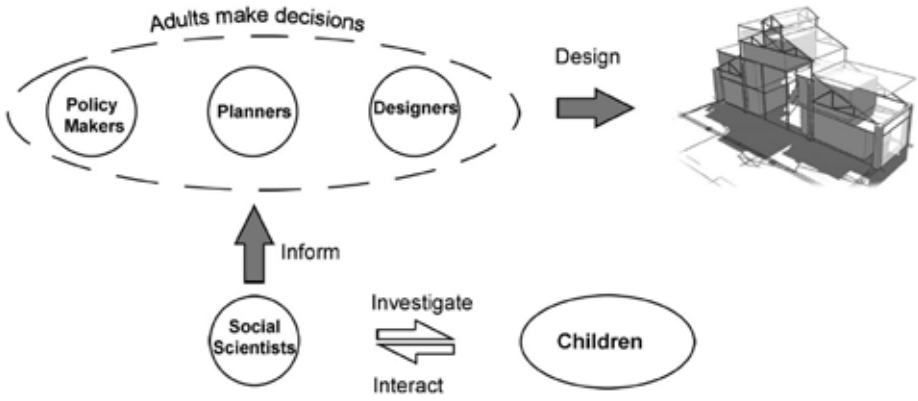



Figure 4. The *Social scientists for children* model (Lozanovska & Xu, 2013).

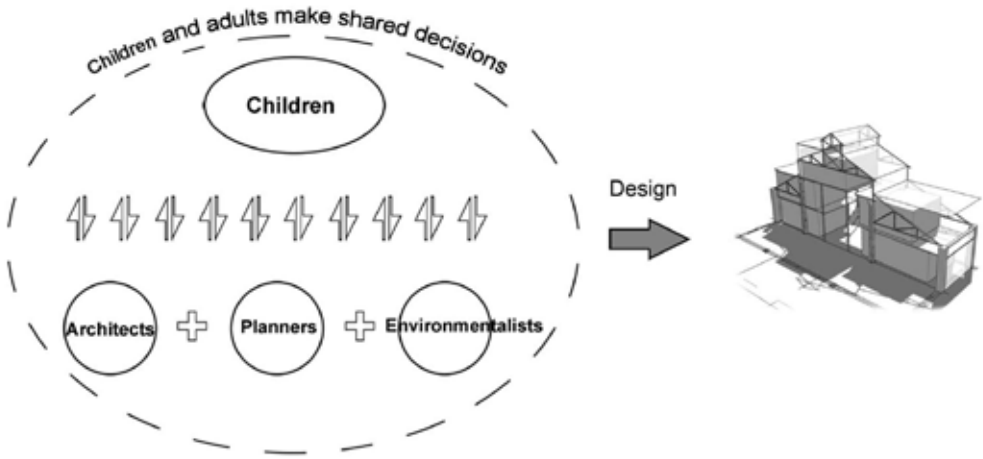



Figure 5. The D*esign with children* model (Lozanovska & Xu, 2013).

These models have represented their scope and limitations as well as reviewed the projects which applied these models. Each of the models has been later evaluated by Hart's (1992) participation ladder based on children's contribution in design: 1) Manipulation, 2) Decoration, 3) Tokenism, 4) Assigned but informed, 5) Consulted and informed, 6) Adultinitiated, shared decisions with children, 7) Child-initiated and directed, and 8) Child-initiated shared decisions with adults. The levels of manipulation, decoration, and tokenism seldom indicate participation, whereas the other levels are divided by the degree of participation (ibid.).

According to Lozanovska and Xu's (2013) evaluation, the Social Scientists for Children model has been part of the non-participation level; on the other hand, other models have been divided into distinctive levels based on the degree of participation. In the Children's coice model, where children act as informants, they have been consulted and have informed others of their thoughts and experiences. In contrast, the Design with children model is initiated by adults and the decisions shared with children; whilst the Design by children model has been initiated and directed by children.

Later, they provided a Pedagogical model (**Figure 6**), through which primary school children's creativity and imagination inspired university architecture students. Simultaneously, these university students shared their knowledge and skills with the children. The pedagogical model has achieved the highest participation of children regarding the primary school children and university students working initially together and sharing the design decisions with other adult experts (ibid.).

The above models described and reviewed distinctive approaches and procedures focusing on children's participation in design. Based on an understanding of the distinctiveness among these five approaches, I have adopted three of their models: the Social ccientist for children, Designing with children, and Pedagogical models in my research. Furthermore, I have adapted and applied these models' approaches and procedures into my practices with children in this research.

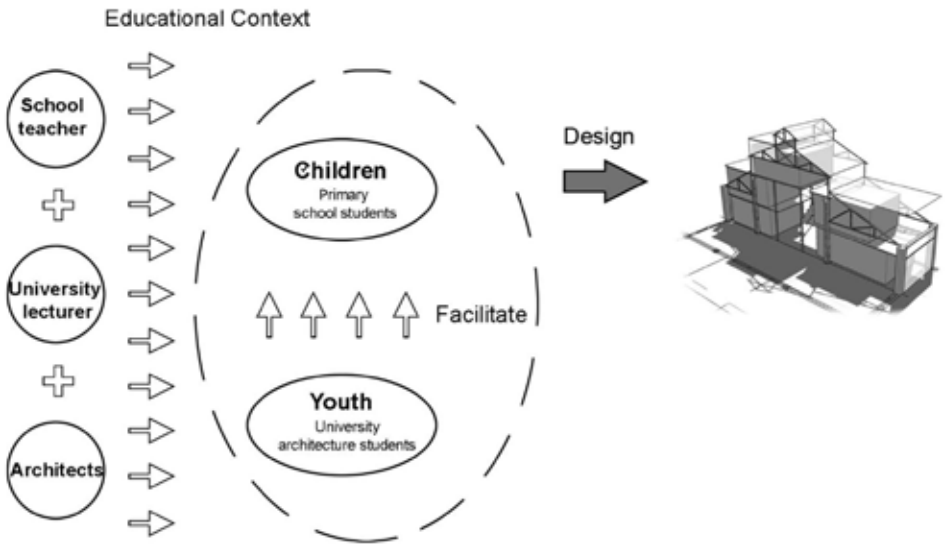



Figure 6. The *Pedagogical* model of children's participation in architectural design (Lozanovska & Xu, 2013).

## Children's roles in design

Since the time children became actively involved and their voices acknowledged in research and design, their roles have been defined according to various approaches and children's contributions (Scaife et al., 1997; Druin, 1999; Kelly et al., 2006; Lozanovska & Xu, 2013). Recently, the new roles of children in design have been highlighted in the IDC/CCI domain (Barendregt et al., 2016; Iversen, Smith, & Dindler, 2016; Kinnula et al., 2018). In this research, I have chosen to focus on two remarkable organisations, which have concentrated on working on designing with children in the USA and UK.

Led by Dr. Allison Druin, the Human-Computer Interaction Lab at the University of Maryland (USA) has run Kidstream, which focuses on creating technology with children and with adults working as design partners. Accordingly, adopted from the Cooperative Inquiry method of design (Druin, 1999), Kidstream concentrates on building technologies that are relevant to children's interests and needs with intergenerational design teams.

Similarly to Kidstream at the University of Maryland, Northumbria University in the UK has conducted ongoing research, and operates a website, Designing with Children. This research aids design practitioners and other experts who are enthusiastic about exploring the ways the design process and built environment are stimulated by children's culture, capacities and imagination. Collecting examples of projects from all over the world, this website provides a database exploring different initiatives, locations, age and size of a working group, stages of projects, and children's roles organised according to the projects. Following the UNCRC definition, the Designing with children website (www.designingwithchildren.net) categorises children as those under the age of eighteen. In this website, children's distinctive roles have been clarified and defined as: advocates for change, builders, clients, co-designers, creative inspirers, expert consultants, placemakers and trailblazers, in the design process (**Table 2**).

I have compared and synthesised the distinctive roles of children between Kidstream and Designing with children with related studies and approaches on design and children, according to Lozanovska and Xu's (2013) stipulation of children's involvement and degree of participation. Figure 7 depicts the different positions of children's roles addressed by other scholars based on Druin's four categories: user, tester, informant and design partner. Her definition of children's roles had a broad spectrum encompassing User-centred design and collaborative approaches. However, unlike advisors in the Children's Voice approach, other approaches have focused on the more active roles of children, such as active designers in Design by children, partners in Design with children as well as partners and decision-makers in the *Pedagogical* model.

The *Designing with children* approach by Northumbria University shows compounded characteristics, which differ from Druin's. Some of the roles appear to match Druin's definition, for instance, co-designer as design partner, and expert consultant as informants. However, many of the designations have displayed broad spectra or even overly specified characteristics compared to Druin's categories. As a result, I have positioned the designations depending on the degree of children's involvement in the inquiries. First, clients can have a wide range of roles among users, testers and informants as well as almost

Table 2. The definitions and description of children's different roles in designing with children (Designing with Children, 2000).

| CHILDREN'S ROLES | Description (the term "children" including people under the age of 18, following the UN definition) |
|---|---|
| Advocates for change | Working to identify and represent changes recognising a lack of opportunities and settings, to make them visible, understood and valued, and to catalyse positive actions |
| Builders | Taking a hands-on role in creating in the new space/place design |
| Clients | Deciding tentative outcomes from design inquiries, providing critique on the design development, and deciding results from the designers throughout the design process |
| Co-Designers | Making decisions about designs being created through a process of presenting those design inquiries |
| Creative Inspirers | Envisioning, imagining and proposing qualities of space and place, and the activities therein; developing and communicating these using a variety of creative media; inspiring the design team through the outputs for developing the design brief or qualities and content of the spaces |
| Expert Consultants | Providing a source of information and data about their experience, such as direct feedback on the experience of a place, or views and opinions of a broader group of children and their preferences |
| Placemakers | Making physical changes to the space they already inhabit, to meet their changing needs and aspirations. This act of changing space, therefore embodies an evaluation of what works and what does not, and critiques prior experience of that place. |
| Trailblazers (pioneer) | Developing and creating a prototype of something envisioned for the new space and trying it out to see what can be learned, and how this might inform the design. The findings of this experiment can directly notify the brief or developing design. The process itself might also change user attitudes or develop capacities for future space-use. |

reaching the level of design partners. Secondly, creative inspirers have been positioned under the expert consultants in the same range of informants. Thirdly, builders and placemakers could be positioned in the design partners' range. However, these could have less impact on decision-making compared with co-designers. Fourthly, advocates for change have also held more active positions. Finally, trailblazers have extended the scope of roles by developing, creating and testing a prototype; therefore, these could cover a wide range of roles (**Figure 7**).

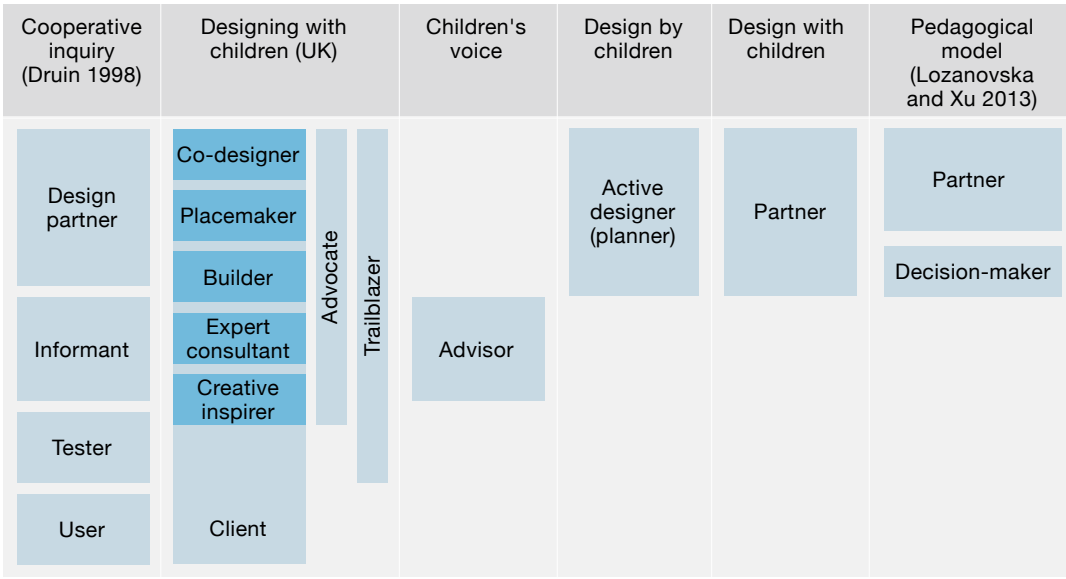



Figure 7. The position of children's roles according to different approaches.

## Ethical stance in Participatory Design

In PD, ethical issues have been considered to be a provocative topic. It began with a desire to respect people's expertise and their rights to represent their activities to others (Robertson & Wagner, 2013). Understanding each other's perspectives and priorities are initiatives for constructing close relationships. This thorough understanding and cultivation of respect form a bond in these relationships, thereby providing an optimal platform for mutual learning to occur (ibid.). For these reasons, ethnography is a relevant method in PD enabling designers to develop an understanding of the lived experience of users.

Based on the questions in relation to the Ethics in PD by Robertson and Wagner (ibid.), I focus on the contexts of designing for and with children: 1) engagement with children; 2) ascertainment of the power between adults and children; 3) dealing with sensitive topics; 4) ensuring children's confident and secure feeling; 5) avoiding the risk of children being embarrassed or unpleasantly surprised; 6) protecting and fulfilling children participant's privacy; and 7) ensuring children's safety in the PD practices.

I initially defined that I would engage and involve children in this research. Children are the main participants and interact with other related stakeholders, including adult designers and researchers, educators, and experts in these PD practices. According to the UNCRC, every child should be considered to possess their rights regarding their freedom of expression, education, development and their well-being (1989). Thus, from an ethical PD stance, it is clearly a challenge engaging with children in projects as certain aspects must be carefully considered and planned for, such as the power imbalance between the young participants and others, the working conditions and environment, as well as the protection of children's privacy and ensuring their safety (ibid.).

## Materials in design

In the Montessori approach, materials occupy significant roles and perform as remarkable characters in different domains. Regarding the design domain, materials can be implemented into either focused or extended meanings depending on inquiries. The Montessori approach encourages harnessing the materials available in the surrounding environment to promote learning through hands-on-activities (Montessori, 1994, 2004). In this approach, materials are utilised as a Didactic tool (http://www.educativ.info/edu/licee5.html). Maria Montessori believed that materials emphasise tactile learning with the tangible materials acting as the didactic tools in child education. Through the materials, self-motivation is instilled, and hands-on learning is promoted in children.

The definition of 'material' itself encompasses distinctive meanings and perspectives depending on different contexts and situations. As a noun, 'material' literally refers inclusively to a physical substance, information, cloth, and equipment (Cambridge Dictionary). In addition, it cannot be merely an unprocessed raw substance, but also a source for a new cycle of production to create new substances and products. In this research, the term 'materials' refers to both the physical substances surrounding us, and the artefacts developed for children's understanding and learning about the physical substance.

The meaning of materials indicates distinctive emphasises among art, craft, and design. Based on Dewey's (1980) emphasis on material engagement in the process of thinking and reflecting in the field of art, craft has stressed logical thinking and material engagement through the senses and process of learning and understanding through practices (Adamson, 2007; Mäkelä, 2007; Nimkulrat, 2012). In particular, craft has emphasised intellectual thinking through the process of making materials into objects (Sennett, 2008) including the process of learning and understanding through material experience (Gray & Burnett, 2009). Carter (2004) has addressed the interaction between materials with the maker's hands, mind and eyes in a creative process.

Whilst expanding the meaning of material in design, designers have attempted to explore new materials and improve the finishing qualities of products applied to the particular materials. However, beyond exploring new materials and improving the final attributes of products, the meaning of material has expanded its boundaries to other domains, such as data, information, toolkits, techniques, and others depending on different contexts and situations. Many scholars have discussed the various aspects of materials in design research, such as Ehn and Kyng's Cardboard computers (1999), and Eriksen's Material Matters in Codesign (2012).

There are at least three distinct uses of the term, materials. In some instances, the word is used to refer to general 'resources,' including products, information, toolkits, and PD stimuli, that can be used as generative objects to create dialogue and elicit insights (intangible things) for the design of other (new) objects. In other instances, such 'resources' are used directly to create tangible new objects as end outcomes (e.g. re-use of cartons and bottles). Still, in further instances, the word is used in the specific sense of raw or semifinished matter that needs to be transformed (e.g. shaped, joined and finished) into an object, but which in its original presented form does not suggest a particular purpose. These distinctions are important and should come across very clearly at the beginning of the study.

Within the boundary of design, materials have been referred to by different terms and foci from UCD to Co-design. Mattelmäki (2007) has claimed the importance of distinctive meanings of materials to connect designerly thinking to the users' experience with

design probes. In addition, Eriksen (2012) explored material matter in Co-design to move forward to more different implications of materials in different settings. Sanders and Stappers (2013) also referred to materials as a convivial toolbox to generate active and collaborative approaches in design. These could be seen as generative objects in generative research. Furthermore, materials have been referred to as primary substances that assist children in sharing their ideas and thoughts when working within an intergenerational team in the IDC/CCI communities.

However, these references have not covered examples of working with variously aged children. To focus on children, Cooperative Inquiry (Druin, 1999) has been one of the bestknown methods involving children in the design process in the domain of IDC/CCI; therefore, several techniques have been implemented working with children in the design process. In particular, Bags of stuff has comprised of arts and crafts supplements for low-tech prototyping, which has been one of the key approaches in Cooperative Inquiry.

By emphasising the learning process and understanding of material in craft, the Finnish comprehensive curriculum has equipped students with a diverse knowledge of techniques and materials, as well as management of tools (Seitamaa-Hakkarainen & Matinlauri, 2015). Although the Finnish education emphasises a knowledge of materials, there are limited opportunities to learn about them in the school curriculum. Based on the inclusion of real-life problem-solving exercises (Eggleston, 1976), design research and practice may provide a new direction for children's education.

The two FabLab Schools (i.e. FabLearn Labs at Stanford University, and FabLab@School at Aarhus University) have strengthened the concept of the Scandinavian tradition of design and innovation processes in primary and secondary education. IDC/CCI domains have actively delved into design-based learning for the school context and the tools supporting children's learning (Bekker et al., 2015; Smith & Iversen, 2015; Eriksson et al., 2018). Beginning from these common foci on learning in crafts and design, Giannakos and Divitini (2016) have discussed engagement and creativity in learning through making. Inspired by the concept of FabLabs in education, this research accentuates its position by building on the fundamental experience of

materials as substances, and learning through materials, which have been developed for and with children, as well as integrated into their comprehensive education.

Whilst this literature review has supported me in gaining a fundamental understanding of PD with children, it has also simultaneously revealed the slanted tendency of previous research. Even though children's involvement and participation have been acknowledged, and the influence and spectrum of PD have been broadened to diverse domains, there is still an imbalance in the power relationship between adults and children, especially adults' lack of understanding and respect towards children. Moreover, this review procedure has also led me to construct a feasible research focus and questions, as well as methods, including techniques and approaches, thus aiding me to dive into the practices with children.

In this literature review, I have discussed research and design practices related to children. From Cooperative Inquiry as a design method collaboratively working with children, I have examined different techniques for and with children. However, the existing methods and procedures have been developed and applied primarily for developing computational and communicational technology, as well as architectural and spatial design practices, rather than small-scale product development. In addition to the implication of the methods, the settings require better conditions, such as a small group of children and a pre-set environment. Therefore, only a limited number of children could participate.

Moreover, these theories and practices have merely emphasised children's contribution and participation, often missing acknowledgement of adults and the importance of their roles. The definition of participation and principles of PD have been examined concentrating on the PD practices with children. Based on this, children's participation has been evaluated through Lozanovska and Xu's models, and some of the models inspired to frame approaches and procedures of my practices with children in this research. Consequently, I hope to fill a niche in which to position my research as well as reframe the research questions and foci of the study based on the literature review.

## 1.2 Research focus and research questions

By allowing the appropriate participation of end-users in the design process, designers can create the space to develop their work. Thus, it is an ideal notion to undertake projects with the involvement of users already in the development process. Indeed, according to this participatory approach, we lack a concrete instance of successful products. Although the performance of children in research and design practice has been highlighted, there is still a tendency to focus on environmental planning and computational development, rather than developing tangible products and everyday goods, such as furniture, clothes or toys for children.

Regarding the active involvement of users as highlighted by Sanders (2013), the transition of roles refers to not only designers or researchers, but also users. Users had been regarded as one of the passive objects of study. Nevertheless, the researcher has gained knowledge from theories as well as developed more knowledge through traditional research approaches, such as observation and interviews. Compared with the UCD approach, in PD and Co-design, the designers and researchers have provided stakeholders with the tools for ideation and expression; therefore, their design skills have recently been highlighted in development of the tools (Sanders & Steppers, 2008).

Among the multiple roles of designers or researchers, their roles have transitioned from that of translators to facilitators (ibid.). In addition, Lee (2008) has pointed out three new roles of designers: design developers, design facilitators, and design generators. She has also addressed different design participation developments: the aesthetic quality of design practice, as well as the collaborative relationship between design research and participatory design thinking (ibid.). However, as I noted above, many of the works in IDC/CCI, projects of PD and Co-design with children have focused on the active involvement of children and their different roles in the design process, rather than acknowledging the adult designer's facilitation and paying attention to their roles.

This research is preliminarily established from a broad research question seeking the ways an adult designer (design practitioner) communicates and collaborates with children in the design process.

To reiterate what I noted in the Introduction: according to three sub-research questions concerning to the main question, this study focuses on exploiting an adult designer's positions and roles in designing *for* and *with* children.

**RQ: How do adult designers (design practitioners) communicate and collaborate with children in the design process? What are the positions and roles of adults in the designing *for* and *with* children?**

- **SQ1. How do adult designers (design practitioners) understand children's position and their roles in the design process?**
- **SQ2. What kind of approach and procedure should be used when designing for and with children?**
- **SQ3. What are the manners and tools that enhance interaction and communication with children in the design process?**

Based on these questions, the objectives of this study are threefold: 1) to understand the value of children's participation in design, 2) to position the designer's role in designing for and with children, and 3) to provide practical guidance, including manners and techniques, for adults (design practitioners and researchers) working with children. Most importantly, this study aims at examining the well-being of children when initiated by their participation and collaboration.

Referencing IDC/CCI's recommended age group (Read & Markopoulos, 2013), the main target groups under study are seven- to twelve-year-old children, thus focusing on primary school-aged children. At this stage, children are in their middle childhood in child development. Entering this stage, children dramatically grow in certain areas of development: physical, cognitive, and social personality. Particularly in cognitive development, intellectual abilities and memory become more advanced during middle childhood. They present diverse elements and types of intelligence, and social interactions aid the development of intellectual skills (Feldman, 2010). However, this study diverges from this exclusion by also studying younger children and teenagers.

## 1.3 Research materials and methods

This research has been undertaken through my practices with children. Therefore, the collected research materials from the practices have been archived as the primary sources and marked as Archive of Bang Jeon Lee (ABL) in this research. As I described in the Introduction, as a design practitioner, I have constructed and conducted eight different design activities with children: Case 1 Månen, Case 2 ARKKI session, Case 3 Hut-building, Case 4 Organic architecture, Case 5 Dream park, Case 6 Build my city, Helsinki, Case 7 Build my city, Seoul, and Case 8. Build my space. During these practices, I have collected substantial research materials by using photographing and video recordings, sketching, interviewing, documenting through notes and memos, arranging workshops as well as gathering children's written and visual outputs. The collected research materials have been presented by diagrams and transcripts from the primary data analysis. Additionally, I have used notes from relevant lectures, seminars, and conversations with my advisors and supervisor.

**Table 3** depicts the different data collection from the cases. The eight cases have applied different data-collecting techniques. This research has been conducted in real settings, i.e. with ordinary pupils in schools, rather than working with a small number of selected participants in laboratory settings. This is proof of broad accessibility with a larger sized group and it means a more feasible approach in the current educational setting.

Although different data-collecting techniques have been chosen and conducted using the same adopted approach, the resulting models of practice were primarily selected due to the ages of the participating groups and activities. In addition, different settings, i.e. different class schedules and schools, effected the choice of data-collecting techniques.

The collected materials from the cases are linked to prior references in this research. After undertaking the cases, the data has been analysed. I have listed the data in Excel sheets to seek answers to the research questions from the data. In addition, I have rewritten and synchronised qualitative data, such as field notes, memos, descriptions of photos and videos in PowerPoint slide form. The listed data have been grouped and categorised into smaller groups depending on their similarities and differences. For the sake of readability, significant data

has been illustrated in diagrams. Subsequently, different categorises have been combined with the extensive system, which was rendered meaningful insights according to the contents.

Table 3. The different data collection from the cases.

| | CASE 1 *Månen* | CASE 2 *ARKKI observation* | CASE 3 *Hut-building* | CASE 4 *Organic architecture* | CASE 5 *Dream park* | CASE 6 *Build my city, Helsinki* | CASE 7 *Build my city, Seoul* | CASE 8 *Build my space* |
|---|---|---|---|---|---|---|---|---|
| 1. Diagram | | | O (Affinity dia-gram) | O (Collage, Matrix) | O (Collage, palette, matrix, palette) | | O (Collage, pal-ette, matrix) | O (Collage, palette) |
| 2. Memo | O | O | O | O | O | O | O | O |
| 3. Fieldnote | | O | O | | | | | |
| 4. Interview | | O | O | | O | O | O | O |
| 5. Photo | O | O | O | O | O | O | O | O |
| 6. Question-naire | | | | | | O | | |
| 7. Sketch / drawing | O (Participants' drawings) | O (Participants' drawings) | O (Design researcher's sketches) | O (Participants' drawings) | O (Idea bubble, Participants' drawings) | O (Participants' drawings) | O (Participants' drawings) | O (Participants' drawings) |
| 8. Writing | | | | | O (Idea bubble) | O (Participants' written stories) | | O (Participants' written answers) |
| 9. Video | O | | O | | | | O | |

*Note. As the primary source in this research, the different data has been collected from my practices working with children.*

Photos and memos have been initially collected to document the process and capture prominent moments and findings in the practices; however, only relevant data has been included to address significant features and phenomena. The fieldnotes have only been collected in the ethnographic studies. In addition, sketches and drawings have mostly referred to participants' creations in this study, excepting the sketches in Case 3 *Hut-building*. As documentation in the ethnographic study, I have sketched the process of building huts and tree houses. The participants' sketches and drawings have been saved as scanned images and photos rather than including the original drawings.

I have undertaken semi-structured interviews in the ARKKI observation and Hutbuilding case, as well as, conducted a casual conversation with designers, schoolteachers, educators and experts in child education and development, and documented in writing any significant comments and feedback in the different stages of the practices.

Furthermore, the format of data collection changed with the children. First, a paper questionnaire was distributed to the children and used to gain data in Case 5 *Dream park*. However, I decided to change the data collection method for Case 7 *Build my city, Seoul* and Case 8 *Build my space* and forwent a written questionnaire in favour of group discussions. In two different Cases 6 and 8, I collected participants' writing without editing in any way their original texts. The collected data revealed greatly depending on the writer's ability to express themselves.

In spite of the practical merits of video data in research with children (Iversen, 2005), the video data has been used and distinctively analysed according to the objectives of the practices in this study. In the Hut-building Case, these video data have been used as supportive materials since they have presented the overall environment and situations of the events; however, some video data has been transcribed to capture a specific sequence during the hut-building activities (Appendix 4). Comparatively, in the Build my city, Seoul case, the video data has been collected from the period during which the participants have displayed their visual outputs on the map of Seoul since this moment has presented a collaborative work by the participants. This presentation has indicated significant features of this group of children compared to other groups in Case 5 *Build my city, Helsinki*.

I explain the preliminary settings, groups and primary objectives of each case and my research practices below.

- **Case 1** ***Månen:*** Based on the above trajectory engaging children as end-users in product development, this practice originated from my Master's thesis, completed in 2009, Dal: The experiment user-inspired design project with children. Based on a participatory design approach, the children were first invited to the product development project. The case aimed to demonstrate and evaluate the involvement of children in certain design phases, and to examine the benefits possibly experienced by the children through the participatory and collaborative approach. This case represented a hands-on project to develop physical products in which children acted in various roles in the different design stages. From this foundational study, the first case has continued to proceed in focusing on implementing the designed outcomes in activities with children. Through this practice, I have examined the mutual learning between an adult designer (design expert) and children during the design process. Hence, this case has emphasised a novel approach to engage children in furniture design and thoroughly examine the roles of both adult designer and children.

- **Case 2** ***ARKKI observation:*** Preliminarily, I conducted observational studies on children's activities to gain a general understanding of children's interests and environment for which I conducted observational studies on children's activities of indoor settings organised by ARKKI (*Lasten ja nuorten arkkitehtuurikoulu*, in English School or Architecture for Children and Youth) in Helsinki, Finland in Spring 2012. This case was a type of after-school activity organisation and children could learn about designerly and architectural skills, as well as knowledge through the activities provided. The different groups were arranged depending on children's ages (4-6 years, 7-9 years, 10-12 years, and above 13 years) and the language of instruction (Finnish, Swedish or English).

- **Case 3** ***Hut-building:*** This case involved a short-term observational study on a children's outdoor event undertaken at Hut-building camp in Espoo, Finland in June 2012. This case offered an experimental opportunity to work with children in outdoor settings and simultaneously engage in natural conversations in a child-friendly environment throughout the process from a designer's point-of-view. It demonstrated the effectiveness of design ethnography in understanding children's play and culture in naturalistic settings (Wyeth, 2006; Pellegrini, Symons, & Hoch, 2004). Through this practice, I could initially investigate several interesting elements: 1) meanings of children's play; 2) children's interests and disinterests; 3) different roles of children and adults; 4) activities initiated by children and adults, respectively; and 5) children's distinctive notions of result and process. Afterwards, the investigation focused on children's motivation, participation, and collaboration during the event. This research allowed adults to gain greater proximity to the children and their environment, to highlight their voices and rights, as well as to enhance their participation and collaboration in the design process. The observation indicated that children's collaborative work potentially revealed their views and needs in their social lives and capabilities. It could also be relevant regarding possible design opportunities for and with children. Consequently, it resulted in addressing the main contribution to this research in Designing with children. Namely, this case contributed to providing considerable practical guidance for adult designers or researchers who work with children, such as the initial process of building relationships, relevant responses to children's expressions, as well as encouraging children's participation and collaboration in order to guide them in improving the design process and outputs (Lee, 2017a).

- **Case 4** ***Organic architecture:*** This case was conducted in ARKKI, an after-school facility in Helsinki, Finland from September to December 2012. Each session lasted one and a half hours per week and the whole project for five to seven weeks. The participants (n=26: 14 boys and 12 girls) were

of various nationalities, such as Finns, Russians, Americans, Poles, and Italians; therefore, English was the official language, but Finnish was also used on some occasions. The pupils were separated into three different groups according to their ages (First group: 7–9 years, second group: 10–12 years, third group: 13–19 year). During the material exploration session, the pupils explored different material study approaches, such as material frottage, collages, and matrices. The participants in ARKKI were provided with various materials during their ordinary activities; hence, many of the children already possessed extensive material experience. However, they had little opportunity to explore materials, and physical substances before initiating the designerly or architectural projects.

- **Case 5** ***Dream park:*** This was conducted in Töölö Primary School in Helsinki, Finland in January 2013. This project was arranged on two distinctive dates for material study and material implementation sessions. The first session was conducted for two hours, and the second session was conducted for four hours on another day. The sessions were conducted for two hours in a regular classroom setting with a classroom teacher. All 25 participants, 14 boys and 11 girls were divided into six different groups (two boy-groups, two girl-groups and two mixedgender groups). The pupils were in a bilingual class, ensuring that they were fairly fluent both in Finnish and English. As such, the workshops were organised in English. A designer planned and facilitated the workshops with a classroom teacher collaborating. During the material exploration session, the pupils explored materials through material image cards, collage and matrices. First, the pupils were requested to categorise seven different materials with 50 cards. Secondly, they were requested to select their four favourite cards and to describe the names, feelings and uses of the materials on the other side of the cards. The pupils had been requested to collect materials from their surroundings as a pre-task before the exploratory sessions. These collected materials were displayed in the classroom before the session started. After the activities with the material image cards,

the pupils explored the different materials, displayed in the classroom. They selected four different materials from which to create material collages. With the material collages, the pupils compared the different feelings of the materials and placed them on material matrices on the wall. The teacher and the author guided and assisted the pupils with positioning their material collages on the matrices.

- Case 6 ***Build my city, Helsinki:*** The activity of constructing physical structures with material blocks was piloted and developed with children during 2012 and 2013. These blocks were constructed on the dimensions of 45 millimetres by 45 millimetres with four grooves on each side and 90 millimetres by 45 millimetres with six grooves; these were made from two millimetre thick cardboard sheets. In connection with developing these toolkits, I organised the Build my City project for one class of 22 pupils in the fifth grade in Töölö Primary School, in Helsinki, Finland on 15 May 2013. This case was a continuation from Case 3; most of the settings and data collection were similar to the previous case. This project included various activities, such as discussions, building, drawing, writing and displaying from multidisciplinary aspects. Each participant created a model with material blocks, drawings, writing questionnaires and creating a story. As a collaborative activity, the pupils displayed their buildings on the map of Helsinki and built their new city. The classroom teacher and I were involved in this project as adult supervisors. This project required making spaces and materials available to the pupils, and setting up the project to fit it into an educational context. We supervised the pupils' work, introduced this project, defined its objects, explained the activities and tasks, demonstrated techniques for performing the activities and tasks as well as collected each design outcome at the end of the project. To help this facilitation, we conversed with each pupil individually to listen to and discuss their design ideas, and supervised them if they had conflicts or problems in developing the project. During the project, we adults provided a wide range

of design activities, including discussion, sketching, model making, and storytelling. The pupils performed as the actual designers of the city planning. They created the design ideas and realised them through various means. Simultaneously, the pupils learned different designerly skills.

- **Case 7** ***Build my city, Seoul:*** This case was part of the Build my City project; therefore, this session followed the structure of Case 6 *Build my City, Helsinki* which was conducted earlier in May 2013. This case was conducted in Yeonhui Elementary School in Seoul, South Korea, in November 2014 and structured as a one-day design workshop lasting for three hours. The pupils (n= 26, 14 boys and 12 girls) were Korean and mostly 10- to 11-years-old in the fifth grade. The workshop was conducted in Korean. The participants worked as individuals or groups (two boy groups, two girl groups and two mixed gender groups) on different activities based on the instruction. The pupils experienced different material study toolkits through diverse activities following the structure of the material exploration in Case 5 *Dream park*, and the material implementation in Case 6 *Build my city, Helsinki*. First, the pupils explored different materials with material image cards and were requested to choose nine favourite materials and write those down in the material palette sheets. Secondly, the pupils experienced tangible materials from the sample kits, which were newly implemented, as well as created four material collages and material matrices using the sample kits. Thirdly, they used the material building blocks for designing new buildings. The structure of the material study followed the first case. Compared with the previous case, a different format of the material palette and material sample kits were added to this project to enhance the children's tangible material-experience.

- **Case 8** ***Build my space:*** After Build my City project with Finnish and Korean fifth graders, I organised Case 8 *Build my space* project, which was conducted as two days workshops with Korean second graders. I invited 25 pupils, 13 boys and 12

girls, and mostly seven- to eight-years-old. The workshop was conducted in Korean with the participants working as individuals or groups on different activities based on the workshop instruction. As the similar procedure and structure to that of Case 6 *Build my city, Helsinki* and Case 7 *Build my city, Seoul,* I organised and facilitated the workshop, and a classroom teacher assisted during the sessions. However, the sessions, in this case, were allocated across two separate days. Furthermore, the topic of design inquiry retrenched the scale from city to their own space due to the importance of the subject being sufficiently familiar to the younger participants. Moreover, the material sample kits had also been developed in a tangible format.

This research initiated from products-based research and design. Norman and Verganti (2014) has introduced The Design Research Quadrangle, which includes two dimensions of product design: novel interpretation of meaning and consideration of practicality, as well as positions design research into four quadrants: 1) basic design research, 2) design-driven research, 3) human-centred research, and 4) tinkering (ibid.). Inspired by this, this research has been grounded in design-driven research, which aims at envisioning new meanings intended to be applied to products; as well as human-centred research, which aims at detecting existing definitions and needs to design products that fit those meanings and needs (ibid.).

In this study, there are two different levels of implementing methods: a systemic method and a contextual method. On hand, as a systemic method, this research has been framed as stated earlier by experimental design research (Sanders & Binder, 2007). **Figure 8** depicts the relation between the programme (P), research questions (Q) and experiments (X) in design research driven by designerly experiment.

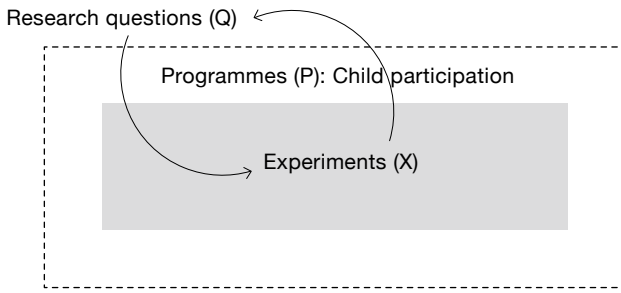



Figure 8. The relation between programme (P), research questions (Q) and experiments (X) in design research driven by designerly experiment (Brandt & Binder, 2007).

Through the experiments (design practices), several of the research questions could evolve and be articulated. The questions have exploited concepts, such as child participation, whilst the programme has framed and contextualised the designerly experiment to engage children actively in design through implementing specific methods and tools.

On the other hand, PD has been used as a contextual method, and my own practice, *Tangible ideation*, has introduced and developed various tools, which are tailored by *Cooperative inquiry* techniques for larger groups of children and less adults. As a contextual method, I have designed this research according to the principles, aims and application of PD. The six significant principles of PD: 1) equalising power relationships, 2) democratic practices, 3) situation-based actions, 4) mutual learning, 5) distinctive and appropriate tools and techniques to support actors express their needs and visions, and 6) alternative perceptions about technology, are grounded in a democratic situation and power relationships, mutual understanding, and collaborative work environments between all the participants (Simonsen & Roberts, 2013). In addition, the commitments of PD are to gain mutual learning among the participants and establishment of the mutual learning process (ibid.). Genuine participation in design (Bødker et al., 1987) refers to the transcendence of the users' active role, rather than just being informants, their actions are acknowledged in the design process. To achieve the collective discussions and reflections, building relationships between all the participants are fundamental initiatives (**Figure 9**).

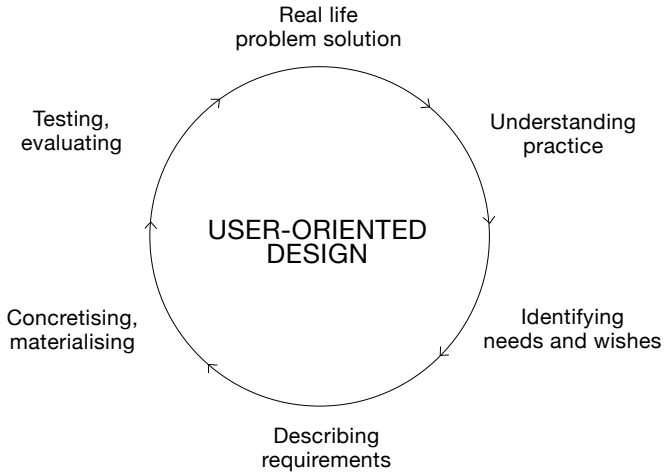



Figure 9. The user-oriented design cycle (Bratteteig et al., 2012, p.128).

PD aims to purposely involve users in the analysis as active subjects, ensuring that the analysis becomes not only a joint activity of understanding the contextual conditions for the design, but also an activity of exploring opportunities for change. For current PD, it seems natural to widen the PD perspective to include from 'design in use' to 'design-after-design'. Therefore, PD practitioners have been faced with refining their approach and the visions resulting from the PD process (Bratteteig et al., 2012, p. 135). This iteration and reflection should be considered when we conduct and apply PD to practices. However, it is difficult to rigorously distinguish between analysis and design in PD. Figure 8 describes the procedure and cycle of user-oriented design. We understand the situation, suggest a design solution, analyse and evaluate, and then we understand the new situation, and suggest a new design solution. During this iterative process, we develop artefacts as a design suggestion based on our understanding of the real-life situation as well as analyse and evaluate them throughout the practices. Afterwards, we may face a new situation and suggest new design solutions (ibid.).

Through this *experimental design research* method, I have provided an overview of the organisation of this research, the planning of the activities according to the research questions, as well as the implementation of the programme and experiments to strengthen the dissertation. The

different data-collecting techniques and analysis methods have been applied to the eight different cases as the working methods. It was relevant to consider including and omitting some sources when I chose the data-collecting and analysis techniques. **Table 4** captures the applied techniques and methods in each experiment (Case), as well as presents my models of practice inspired by Lozanovska and Xu's models (2013).

Table 4. The different techniques applied my own approach and models of practices.

| CASE | TECHNIQUES | ADOPTED APPROACH | RESULTED MODELS OF PRACTICE |
|---|---|---|---|
| CASE 1 *Månen* | Memos, photos, drawings, videos | PD in Product design practice | *Designing* for *and* with *children* |
| CASE 2 *ARKKI observation* | Memos, fieldnotes, interview, photos, drawings | Ethnography | *Social science for children* |
| CASE 3 *Hut-building* | Diagrams, memos, fieldnotes, interview, photos, sketches, video | Ethnography | *Social science for children* |
| CASE 4 *Organic architecture* | Diagrams, memos, photos, drawings | Pedagogical PD | *Tangible ideation* |
| CASE 5 *Dream park* | Diagrams, memos, interviews, photos, questionnaires, drawings, writings | Pedagogical PD | *Tangible ideation* |
| CASE 6 *Build my city, Helsinki* | Memos, interviews, photos, drawings, writings | Pedagogical PD | *Tangible ideation* |
| CASE 7 *Build my city, Seoul* | Diagrams, Memos, interviews, photos, drawings, videos | Pedagogical PD | *Tangible ideation* |
| CASE 8 *Build my space* | Diagrams, Memos, interviews, photos, drawings, writings | Pedagogical PD | *Tangible ideation* |

# 1.4 Structure of the research

This section explains the overall structure and process of this research. Within designing for and with children as the research context, the research questions have been responded to throughout the process: whilst collecting research materials, analysing the materials through viewpoints and methods, and the findings of the main three principles as well as reflecting on the position and roles of stakeholders (**Diagram 1**).

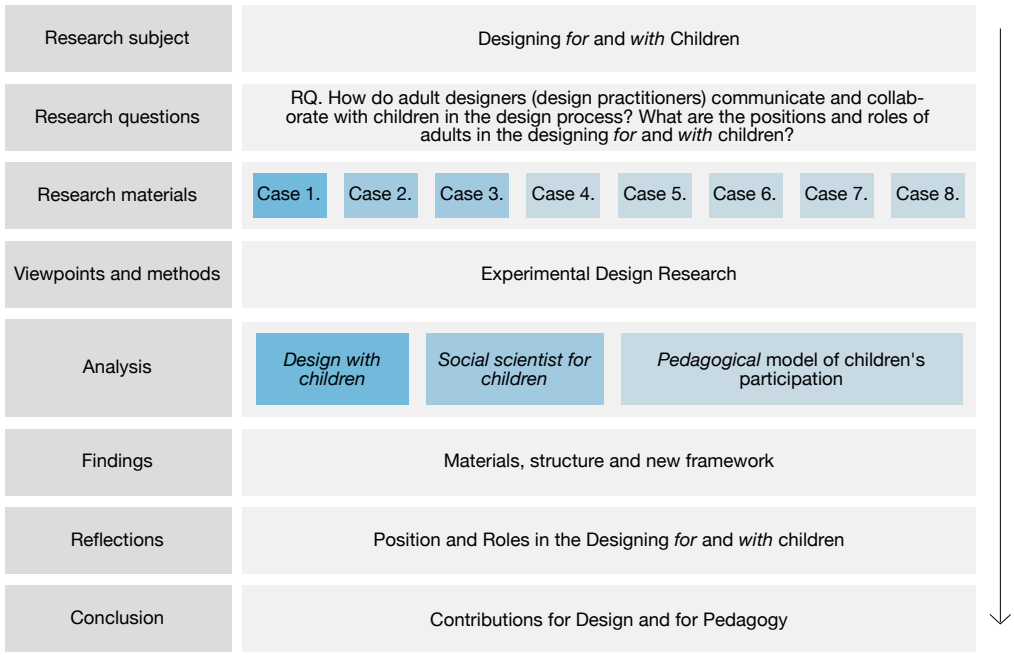



Diagram 1. The research structure and process.

As I mentioned earlier, this research has been undertaken through my own practices with children. Therefore, the collected research materials from the practices have been used as the primary sources in this research. To fill the gaps between the earlier research in IDC/CCI and PD with children and position my own research related to these domains, literature and previous works have been included as secondary references in this study. The secondary sources refer to other scholars' research and practices with children; therefore, I have reviewed and reflected on their theories, methods and approaches to set up my own viewpoints and methods

in this research. Based on the synchronisation of these two sources, I have analysed the research data from my own practices through three models: *designing with children*, social scientist and *pedagogical* models, sourced from Lozanovska and Xu (2013). After that, I have clarified the main findings: material matters, structure and new framework in this research, as well as reflected the positions and roles of stakeholders in designing for and with children context. To conclude, I address three models of practice: *designing* for *and* with *children*, *social science for children* and *Tangible ideation* in designing for and with children. Hence, the main findings from this research contribute to both design and pedagogy.

## 1.5 Outline of the chapters that follows

This dissertation addresses my own practices of working with children to explore tangible ways of designing for and with children. Here I provide more detailed description of the following chapter in the dissertation. The first chapter, what does designing with children mean, has introduced the starting points for this research, and surveyed related research reviews. Based on earlier studies, this chapter has framed the research focus and questions. Subsequently, it has introduced the chosen research materials and methods of this dissertation.

In Chapter 2, initiating from Månen practice, I describe the transition from designing for to designing with children through a product developmental project with children. I address the triangular relations among a design practitioner, product and process. I also briefly mention the iterative process, generative characteristic of the design artefacts and structure of design practices. Grounded on this foundational work, I frame the foci of this research on children's participation in the design process and relationships among stakeholders, in particular children and design practitioners. This chapter describes the iterative process between designing for and designing with based on my presentation at the Research with and for Children conference at the College of Art in Edinburgh, 8–9 May 2017.

Chapter 3 introduces observational studies on children's activities in indoor and outdoor settings to gain a general understanding of children's interests and environment. Notably, I undertook an ethnographic study in the children's outdoor activity, Hut-Building Camp,

to explore children's participation and collaboration, the relationships among stakeholders, as well as manners in working with children. The chapter was rewritten based on my own publication–*Build together: Observational study on outdoor activities engaging children in design*–at the Cumulus International Association of Universities and Colleges in Art, Design and Media Conference proceeding at Hong Kong Design Institute, Hong Kong, China, 21–24 November 2016.

Chapter 4 describes the pedagogical practice, *Tangible ideation*, which provided a concrete structure in design activities with children in their education. Grounded on the observational studies in Chapter 3, I have concentrated on material matters, and developed material study approaches and toolkits for children and youth. The distinctive material study approaches and toolkits, as well as the five cases, which I conducted in Finland and South Korea from 2012 to 2014, have been described in this chapter.

Chapter 5 is entitled 'Three principles' which illustrates the findings of this research. That chapter addresses material matters, the iterative process, and pedagogical structure in this research based on the findings from the empirical practices and finally introduces a new framework of Designing for and with Children. In addition to the section, material matters in Chapter 5 are partially adapted from another publication–*Tangible opportunity: Material study approaches and toolkits in education for children*–at the EKSIG 2017 DRS Special interest group on experiential knowledge conference at the Delft in the Netherlands, 19–20 June 2017.

Chapter 6 develops the discussion that has addressed the different roles of the participants in this process, as well as the participation and collaboration of children. Consequently, Chapter 7 concludes by proposing a new framework Designing for and with Children emphasising the design practitioner's roles. Furthermore, implementation and reflection of this research have provided a valid reason for further studies in policy-making in child education.

# 2.1 Furniture as a new domain of Participatory Design

Furniture is one of the physical products closely associated with our everyday lives. Depending on the person, furniture is not solely a product, but also holds distinctive meaning for its owner. In contrast to objects, a piece of furniture encounters a long-term cycle of use and has often been passed down from generation to generation. Through this passage over several generations, this object might preserve its stories, such as the length of time it has been in use, the identity of its users or owners, as well as where it has been placed. By crossing over several generations, the furniture itself can be a means of connecting with each individual during the journey. Furthermore, furniture adjoins relations and interactions with space, from personal space extending to public space.

From another perspective, the design of furniture constitutes a realm, which has retained its traditional ways of working and developing. For the carpenter, furniture has still preserved this tradition of maker-oriented production. In other words, the way of working and creating furniture has been initiated by and persisted through the skills and techniques of master craftsmen. In line with the recent active role of people in the development of design, furniture design has also been adapted to a trajectory of involving people. For example, Do It Yourself (DIY) has proven one of the most popular global trends in the furniture industry in recent decades; as a result, the flat-pack pioneer, IKEA, has been highly successful all over the world. Encouraging an active stance, people are also willing to create their furniture; however, this is a unique working environment compared with participatory and collaborative design approaches. The creators have ideas and build furniture with support from the masters' or practitioners' skills and knowledge. This phenomenon is based on apprenticeship: the users are trained or have adapted skills from the masters or practitioners and continue to create their products. Consequently, PD is still a new approach in furniture, despite the increasingly active involvement of users in the design process.

## 2.2 Focusing on actions

As mentioned earlier, the departure of this case arose from my Master's thesis work, *Dal: The experiment user-inspired design project with children* (Lee, 2009). The outcome was indoor furniture, which encouraged children with their physical activities. Despite the trajectory of engaging children as end-users in product development, there have been few attempts to develop furniture with children. In this foundational work, a group of children were primarily invited into the product development stages based on the PD approach. Hence, the case aimed to demonstrate and evaluate the involvement of children in the design phases and to examine the benefits gained through these participatory and collaborative approaches. The significance of this case lay in its practice-based project, which developed physical products in which children acted in various roles in the different design stages. To move on my doctoral research, this practice was renamed as *Månen*, which initiated from the workshop in Barnas Kulturhus in Bergen, Norway in 2012, and means 'a crescent' in Norwegian.

Through this empirical practice, I indicated that the PD approach created artefacts whereby children had various opportunities to play with their friends, siblings, and parents; thus, it encouraged children's social development through interactive play. In addition, this case demonstrated design research through practice by contributing to designers and by design researchers implementing their research in the actual design case (Lee, 2009). It should be noted that the scope of this case has been primarily concerned with the physical interaction between the children and artefacts through a Child-Centred Design (CCD) approach. However, this research method could also be utilised to investigate the results of technology-based interaction. As children grow up in a technology-based environment, they lack opportunities to interact physically with others. In this empirical approach, the physical activities during the children's play led to distinct benefits based on child development (Lee, 2008). Furthermore, this entire research assumed several merits in children's physical, intellectual, linguistic, and emotional development.

In the first chapter, Figure 8 has described the user-oriented design cycle – a continuous chain for understanding practice, identifying

needs and wishes, defining requirements, concretising & materialising, testing & evaluating, to real-life problem solution (Brattegeig *et al*., 2013, p. 128). This project was adopted the process of the user-oriented design cycle and modified the names of the stages. Depicted in Figure 10, the first step was conducted through a fundamental study to identify the needs and wishes of users.

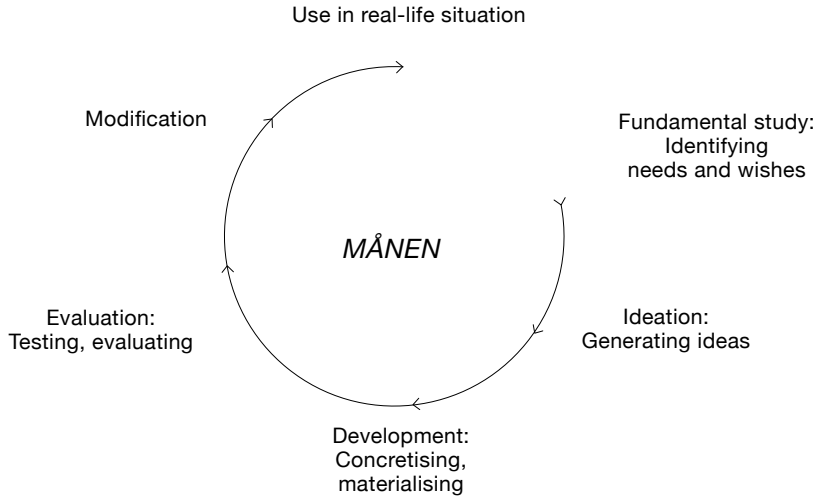



Figure 10. The process of the *Månen* project adopted from the user-oriented design cycle (Brattegeig et al., 2012, p. 128).

Initially, this step also included an understanding of the practice. In the ideation stage, we could generate design ideas. The concretising and materialising should be taken into account in the development stage, and testing and evaluation should be conducted in the evaluation stage. In this modified cycle, I have added the modification stage before moving forward to use in a real phase similar to a real-life problem solution in the user-oriented design cycle. In this project, I have emphasised design development involving children's participation and their collaboration with the adult designer in the later stage of the design process. This is not only a one-time execution, but also multiple implementations to improve the quality of outcomes. In addition, I have modified it by cutting the cycle between the starting and final stages since I have considered the likelihood of the process being continued (**Figure 10**).

After the completion of the Master thesis project, this study has been developed and continued in different locations in Finland,

South Korea, and Norway from 2012 to 2014. Initially, the evaluation was extended to various groups of children in the appointed different places. Some of the children joined in the participatory workshops to initiate the ideation and user tests for the product development in this evaluation. During this extended period, most of the children participating in poster-design activities had no prior engagement with this project. Later, some of the evaluation sessions were arranged as a format for combining workshops with different design inquiries.

Based on the modified design cycle of this project, I have devised the iterative process based on activities in the different stage of the design process: ideation, development, evaluation and post-design. **Diagram 2** has depicted the steps and process. This project primarily consisted of various design activities; however, these design activities could not always constitute products or artefacts during and after the activities. Although the process is linear, there is a possibility to retrospectively examine the stage through the activities.

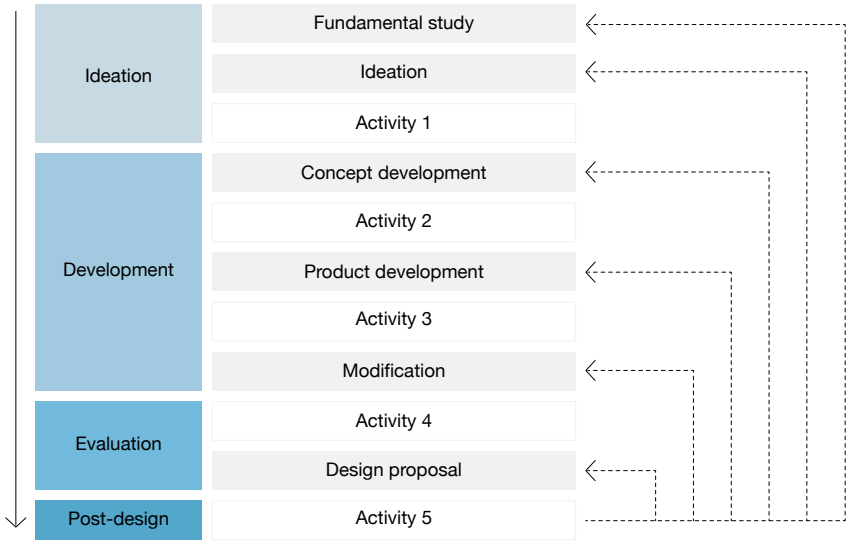



Diagram 2. The iterative process based on activities in the different stage of the design process.

Due to a lack of time and resources for actual world product development, this project is an ideal example of exaggerating successful user involvement in project development. Furthermore, the design experts evaluated a sceptical point on this project in terms of working

with one age group of children (Group 1: 7–9 years), particularly during the ideation and development stages of the design process. It could be utilised with other user groups; moreover, this could not be a problem of the initiative since the design outcomes have been evaluated with different children age groups (Group 2–8: 4–12 years) (**Table 5**).

Table 5: The different activities with various groups of children in different locations.

| STAGES | ACTIVITIES | PARTICIPANTS | LOCATIONS |
|---|---|---|---|
| Ideation | Activity 1. My furniture: a session to investigate children's ideas about furniture and space applied to fabricated materials | Group 1. 7-9 years | ARKKI, Helsinki |
| | Activity 2. My playground: a session to investigate children's ideas about shape and functions used to generative objects | Group 1. 7-9 years | ARKKI, Helsinki |
| Development | Activity 3. User test 1: a session to test the main idea of the products | Group 1. 7-9 years<br>Group 2. 4-6 years | ARKKI, Helsinki |
| Evaluation | Activity 4. User test 2: a session to evaluate detailed features of products, such as size, materials, colours, the finishing of products | Group 1. 7-9 years<br>Group 2. 4-6 years<br>Group 3. 10-12 years<br>Group 4. 4-12 years<br>Group 5. 1-10 years | ARKKI, Helsinki<br>ARKKI Summer camp, Helsinki<br>Korealainen Kielikoulu, Helsinki |
| Post-design | Activity 5. Experimentation: a session to give other children opportunities to experience the outcome | Group 6 & 7. 1-6 years<br>Group 8. 5-12 years | Barnas Kulturhus, Bergen<br>Korealainen Kielikoulu, Helsinki |

To conduct further study, I would need to develop a framework by which both processes and outcomes are evaluated. Most importantly, in this case, participatory approaches have been utilised in real product development for and with children. The design activi-

ties allowed and engaged the end-users' participation in the design process. Simultaneously, I could mutually gain learn throughout the iteration of inclusion and exclusion from the design activities.

All of the sessions were recorded on a camera and a video recorder. The collected data were analysed and were found to have captured significant features of the context (Beyer & Holtzblatt, 1998). The analysis was focused on children's plays during the session and illustrated in **Tables 6** and **7**, which have been included in Appendices 2. It represents the play analysis of a four-year-old boy, and includes play duration, activities, reaction, interaction, play patterns and potential design ideas during the play. This has revealed the different play patterns among the different groups of children who participated in the evaluation session.

The different age groups of children presented not only similar play but also significant play patterns based on their ages. First, the children utilised the prototypes in different ways, such as rocking, building, stacking and arranging. Applying handles to the prototype pieces produced more possibilities for creating new play activities. In addition, different ages demonstrated distinctive play patterns (Barry & Wadsworth, 2003). The younger children (4–6 years) played with the prototypes by rocking and building objects. The older children (7–9 years) attempted to create more unique features out of these prototypes. These results represented distinct characteristics based on the children's ages and these could be seen as evidence from the perspective of child development. For instance, children aged five to six could choose their friends and were aware of fairness, sharing and turntaking; children aged six to eight enjoyed engaging in cooperative play in social development (Lee, 2008). The children invited their friends and parents to join in their playing; for example, several children asked their parents to push them on the prototypes. These actions have illustrated children developing social interaction skills through play. The products significantly encouraged more indoor activities not only from children but also from adults. This social interaction was initially investigated in the earlier evaluation of this project in 2009 and was found in several different settings in a later evaluation.

As described earlier, this research has extended to further design activities applied to design outcomes with children. These activities would benefit from receiving an extensive evaluation of the proposed

artefacts, and these might also engender new design ideas. Through this research, I could transition the trajectory from *designing for children* to *designing with children*: for example, from designing artefacts for children to designing activities with children. I will explain in more depth the process and feature of this transition in the following section.

## 2.3 Transition from *designing for* to *designing with* children

*In Human-centred design (HCD) or user-centred design (UCD), end-users are investigated as the grounding for design rather than fitting the design for them.*
(ABL Memo 2, 2015)

The above quotation came from a lecture by Sampsa Hyysalo during the User-Inspired Design (UID) course at Aalto University, School of Arts, Design and Architecture in October 2015. This has been a cornerstone of my thoughts on User-centred approach (i.e. *designing for*) and a reference to a transition to participatory and collaborative approaches in design.

As a traditional and eminent design process, the *Double Diamond* by British Design Council's (2005) has shown four different stages in the design process: *discover* insight into the problem, *define* the area to be focused on, *develop* potential solutions, and *deliver* solutions that work (ibid.). Consequently, this process aims to provide final solutions. To focus on CCD, the third stage development of potential solutions should be emphasised as a long cycle. Development refers to the entire life cycle of a design project, including analysis, design, evaluation and implementation, from the commitment to product delivery. Here, I would like to point out the stage of design between early analysis and serious implementation (Read *et al*., 2005). Grounded in the *Double Diamond*, I elaborated on the design process concentrating on this project.

*Cooperative Inquiry*, the prior method of designing with children, can be enriched by providing solutions to develop computational outcomes for children. However, the focus of this method has accentuated children's involvement in the design process. Hence, the overall perspective of this whole design process, the participation of children,

is somewhat limited since the focus of children's involvement aims at outcomes, namely finding a solution, rather than defining the problems.

This research represents a product development case in which children were involved in the different stages of the design process with varying roles based on the PD approach. I have mentioned above that this case had emerged from the background of childfocused design from CCD (designing *for* children) to PD (designing *with* children). Adapted from the method of Child-centred product, the development process was categorised in three stages: *ideation* (participatory design workshops with children), *implementation* (designing and developing ideas with children), and *evaluation* (findings for further development).

*Ideation* refers to the design stage between early analysis and implementation (Read *et al*., 2005). Based on the procedure and preliminary findings from the earlier research, I investigated different insights during each stage. Considering child developmental merits, for instance, encouraging children's social developmental skill, this research indicated more potential in the further process after evaluating the final products.

The whole process could be iteratively undertaken with different activities during and after the stages. Aforementioned in the earlier section, Diagram 1 depicted the different stage of design process and activities, as well as further activities in the post-design stage. For instance, the design outcomes applied to the post-activities with children; therefore, the children experienced the final products (**Image 3**).

Image 3. The design outcomes applied to the post-activities with children.

Afterwards, the same group of children drew different plays based on their experience and potential plays with the products (**Image 4**). These ideas have enhanced further development after these post-activities with children.

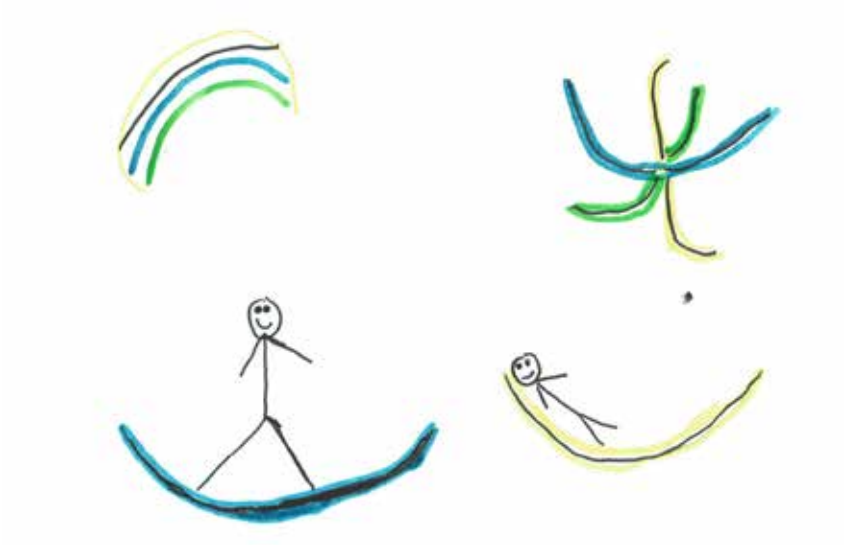


Image 4. The drawings are capturing children's experiences and ideas for further development after the post-activity with children.

This case provided an iterative process model combining research and design practices. The design research has supported active design practice and resulted in good design outcomes. The design practice using final products engendered further design research.

According to the two foci on Interaction Design and Children (IDC) and Child-Computer Interaction (CCI) communities, *designing for* and *designing with* children have emphasised two distinctive perspectives: product-oriented and process-oriented. The former direction focuses on developing computational products and services for children. The latter focus implies the involvement of children in the design process (Iversen, 2005, p.15). However, I claim that these perspectives cannot be separated. The products are designed for children based on CCD, derived from a UCD approach, and the activities are conducted with children during the design process. Therefore, the participatory and collaborative activities applied to the products are undertaken to develop the products for children and evoke further

design possibilities. This is a transition from designing for children to designing with children. These have been guided by the mind-set, designing *for* and *with* children of this research (**Diagram 3**).

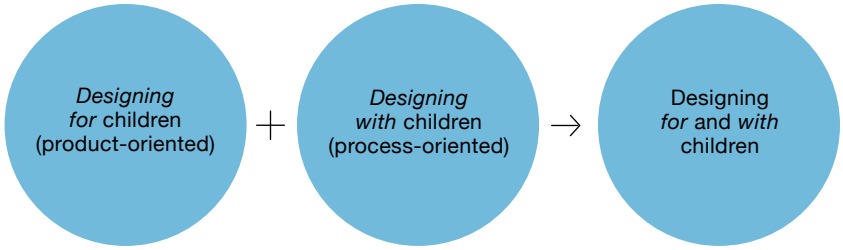



Diagram 3. The transition from *designing for* children to *designing with* children resulted in 'designing *for* and *with* children' as the scope and approach of this research.

Based on Cross' *Designerly ways of knowing* (1982, 2001), I have illustrated two triangles to describe these two directions throughout the process and approach of this project (**Diagram 4**).

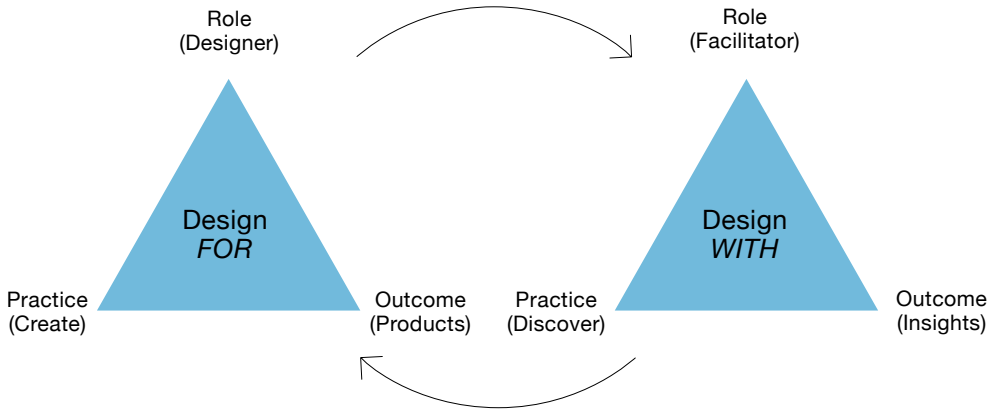



Diagram 4. The iterative approach between *designing for* and *designing with* children adopted from *Designerly ways of knowing* by Cross.

The role of the practitioner, practice and outcome are the primary elements with this triangular approach supporting the theoretical background of this entire research. In these triangles, practice means both creating the design outcome (i.e. products and activities, including planning and conducting programmes), as well as discovering insights during the design activities. This has merged and evolved into an emphasis on creating design outcomes and conducting activities to discover insights focused on the context of designing *for* and *with children*. Practitioners refer to design practitioners that have central and different roles in both approaches. In the *designing for* approach, they adopt a traditional designer's roles based on creating outcomes through practice. On the other hand, in the designing with approach, they concentrate on discovering insight through practice and shifting role as facilitators in activities with children. In the different (design) activities during this research, I have discovered a somewhat identical structure in the activities. The meaning of the programmes and activities, therefore, could be puzzled out in the practice. Instead, I emphasise that the activities refer to the actions implemented, and the programmes refer to the planned structure of the event. As a consequence, I would like to elaborate on these approaches, *designing for* and *designing with* in one loop rather than separating them. These approaches emphasise value and reflection during the processes. Furthermore, the roles of design practitioners during the process should be examined more closely to discuss their positions and manners. I will define and refine the design practitioner's roles in Chapters 5 and 6.

## 2.4 Actors, artefacts and activities

### Mutual learning between the adult designer and children

Effective design requires a mutual understanding between designers and users; therefore, this mutual learning represents a bridge between the different qualifications and expertise of the actors. This learning is one of the core principles in PD with the process being undertaken through various activities leading to an intellectual exchange between actors and worlds. In addition, users and designers learn from each

other's activities; for instance, users learn about operators' instruments and conceptualising skills with the designers during the activities. The products, which are created by designers, serve as a means of representing the designers' viewpoints. Products are connected with users and use of the products in historical, social and cultural contexts. By seeking an understanding of the reciprocal relationships between products, users, society and culture, designers understand users' needs in more depth (Hussain & Keitsch, 2010, p. 153). These also provide designers with the means to construct their ways of seeing and acting with respect to the world (Béguin, 2003).

From this empirical study, *Månen* has proceeded in developing an implementation of the designed outcomes in activities with children. Through this practice, I have examined the mutual learning between an adult designer (design practitioner) and children during the design process. Hence, this case has emphasised a novel approach to engage children in furniture design and thoroughly examine the roles of both the adult designer and children. The children were invited to different stages of the design process: ideation, development & implementation, evaluation and post-activity. I organised the designerly workshops to inform and represent their thoughts about furniture and space, as well as the functions and shapes of objects. In addition, the children were involved in the evaluation session for the product development. In the later arrangement, other children were also invited to participate in the evaluation session. During each stage of design development, I, as the design practitioner (designer), and the child participants gained mutual learning from each other.

**Table 8** has explained the detailed descriptions which both the design practitioner and child participants learned from each other at the different design stages.

Table 8. Designer and children learned from each activity at different stages in the development

| STAGES | DESIGNER | CHILDREN |
|---|---|---|
| Ideation | Understood children's thoughts about the inquiry<br><br>Challenged general notions (adapted children's point-of-view)<br><br>Inspired design possibilities | Learned about designerly skills, knowledge and environment from the designer<br><br>Experienced various designerly activities in their educational curriculum |
| Development & Implementation | Confirmed ideas and the direction of design (quick proceeding) | Learned about responsibility through their active involvement |
| Evaluation | Received practical feedback from the users<br><br>Had chanced to solve problems | Learned about responsibility through their active involvement |
| Post-activity | Received new comments from other stakeholders (who have not been involved in the earlier development processes)<br><br>Inspired new design possibilities | Experienced active physical plays with tangible products<br><br>Experienced designerly activities |

First, in the ideation stage, the designer arrived at an understanding of the children's thoughts about the inquiry, had a chance to listen to their perspectives, and inspired design possibilities. Then, the children learned about designerly skills and the environment from the designer, as well as experienced various designerly activities in their educational curriculum. Secondly, in the development and implementation stage, the designer promptly confirmed ideas and the direction of design, and the children simultaneously learned about responsibility through their active involvement of the design process. Thirdly, in the evaluation stage, the designer received useful feedback from the children as actual users and had a chance to solve problems. The children continuously learned about responsibility through their involvement during the design process. Finally, in the post-activity stage, the designer received new comments from other stakeholders who had not been involved in the earlier development process and then inspired new design possibilities. Then, the children experienced active physical plays with tangible products and designerly activities. Consequently, this practice included the benefits and challenges of involving children in

the design process, and it contributed some guidelines for further studies for design practitioners working on designing *for* and *with* children.

As mentioned earlier, the designer and children faced several benefits and challenges during the design process. I have listed some of the challenges of working with children in terms of the amount of time and effort, the diversity of individual children, imbalance of design activities, as well as the risk of misinterpretation or manipulation of outcomes by the children:

1. The design sessions needed a considerable amount of effort and time. Many design sessions lasted for several weeks, and even short design activities required several days to prepare, facilitate and evaluate.
2. Recruiting participants was also challenging, and children possessed differing competence and skills. Due to their different skills, knowledge, experiences, environment and security, all design activities needed to be adjusted to the average child. However, these activities should also have been sufficiently flexible to adapt to children with special needs, disorders, or difficulties.
3. The outcomes from children needed accurate interpretation and rationalisation. Otherwise, they were often misinterpreted or described in such a way that they were little or of no use to the development process, even though the outcomes from children held potential value.

To increase the benefits of this approach, I concentrated on providing practical guidance whilst working with the children by respecting the child participants, contents of inquiries, working methods and relationships based on and Read *et al.*'s (2005) suggested as outlined below:

1. Respect children when listening to their opinions and comments. Otherwise, children might be less willing to participate and actively perform in the projects. Furthermore, responding to their comments might prevent the risk of misinterpretation or manipulation of outcomes from them.
2. Use scenarios and themes with which the children are familiar. Depending on the objectives of the research or projects, the

activities with children need to be planned within the boundaries of familiar contexts.

3. Explain the whole process of the project in which the children are involved. Children cannot immediately digest the whole scenario, but they can independently navigate through the whole process. Afterwards, divide each stage into smaller parts, and provide tasks to concentrate on exploring each inquiry. Furthermore, a wrapping-up moment should be allocated to reflect on the activities and learn from each other.
4. Remind children of their previous activities. Help them recall their previous activities and validate their previous efforts.
5. Allow children to express their ideas in ways that are more comfortable (e.g. drawings, paintings and prototyping). An individual child has different competencies, skills, experiences, and intellectual abilities.
6. Collect ideas on the same topic in different formats (e.g. words, pictures and models). These countercheck each other and explore more profoundly children's ideas and opinions.
7. Encourage children to carry out their activities in the given tasks. Encouragement empowers the participant with a positive atmosphere, and this may affect the process and results of the projects.

## Design artefacts as Generative objects

Through this practice of developing a physical product for and with children, I need to further describe the relationships among the design practitioner (designer), users (children), and product description within the two triangles. The design outcomes in *Månen* in particular have been implemented as generative objects to gain a deep understanding of children's plays and development. Sanders (2000) named these objects *generative design tools* and the aim of the toolkits was not to find a correct description or interpretation but to seek a deeper understanding of something by seeing it in a broader cultural and social context. The principles of generative design tools should be considered in further research when designing *for* and *with children*:

- *All people are creative.*
- *All people have dreams.*
- *People will fill in what is unseen and unsaid based on their experience and imagination.*
- *People project their needs onto ambiguous stimuli because they are driven to make meaning* (Hussain *et al.,* 2012).

Generative design tools have been applied to co-design with children in the Western context and cultures, and these implementations achieved efficiencies and effectiveness (Sanders, 2000). For the rural environment in developing countries, Hussain and Sanders have used generative design tools working with Cambodian children who have prosthetic legs (Hussasin *et al*., 2012). These promoted active and feasible communication between users (children) and design practitioners. By not merely delivering information from the users to the designer, designers could instead learn about users' needs and requirements through generative objects.

The use of these objects has promoted a new language that creates a synergy between verbal and visual forms of communication. These have allowed users to imagine and express their abstract and rough ideas in a more concrete way. Therefore, the toolkits can be formed in output, such as drawings, maps, models, stories or collages, etc. in twoand three-dimensional perspectives (Hussasin & Sanders, 2012). For a more specific suggestion, these toolkits could be various types of ingredients: photos, words, symbolic shapes, cartoonlike expressions, systematic sets, puppets, velcro-covered 3D forms, raw collections of scrap materials as well as Legos and other construction kits. Depending on the research contexts, these ingredients can be applied to specific settings to trigger participants to use them or encourage others to express their feelings, thoughts or ideas (Sanders & Stappers, 2013, p. 70–71). Furthermore, these could be created by designers or participants, or added by participants. Moreover, the designer as the expert can be absent during the intervention of the toolkits in the dialogues (Hussain *et al*., 2012).

The outcomes of *Månen* have demonstrated the efficiency and effectiveness of this way of working with children by creating generative objects which inspired concrete communication between the

design practitioner and children, thus enabling a deep understanding of children's play and social development. Based on the principles and features of generative design tools, this practice has proven the potentials of design artefacts created by design activities with children for further generative research with children.

## Characteristic of activities with children

In the different design stages, distinctive activities with children were regarded as a focal point when undertaking the whole project. The children were involved in the design activities, such as the workshops and projects; each activity has presented distinguishing characteristics. First, the activities are play-based or play-like types. It is unrealistic to expect children to work and focus for as long periods of thime as adults do. Ample research has proven and suggested working hours for different children age groups. For instance, one class or session should be limited to 40 minutes for primary school children, according to the Ministry of Education in South Korea. Compared with the working period, play could extend the length of operating activities and attention span of children. Secondly, children should receive merits during and through these activities. To utilise the principles of PD, all the stakeholders and parties should receive merits through their participation. Thirdly, these activities comprised a specific structure. According to Lozanovska and Xu's (2013) pedagogical practice, their project tended to consist of three stages: 1) preparation; 2) development of design; as well as 3) installation, evaluation and exhibition. In addition, one other project, with a PD approach, on developing information architecture design for children encompassed five steps: 1) set-up, 2) orientation, 3) information structuring, 4) discussion, and 5) wrap-up (Back & Lee 2008). Regarding the main action as developing design ideas, these structures could be summed up as three stages: before the action, during the action, and after the action.

## 2.5 Key insights and progress in Chapter 2

This research has proceeded in developing the implementation of the designed outcomes in activities with children. Through this practice, I have examined the mutual learning between an adult designer (design practitioner) and children during the design process. Hence, this case has emphasised a novel approach to engage children in furniture design and thoroughly examine mutual learning between the adult designer and children.

Based on product-oriented and process-oriented notions, I was able to consolidate the focus and framework of this research. This chapter has illustrated ideas between designing *for* and designing *with* children with the use of two triangles. To move forward to ground my initial claim, I have discussed the iterative and spontaneous approach of these two approaches: designing *for* and designing *with* children, in the two triangular diagrams. In these triangles, the three key elements—the role of design practitioners, practice and outcome—have been addressed the distinctions and relations to each other. The practitioner has switched her roles with regard to the practices, and she has reflected through the practice and produced the outcome.

Based on this grounding as well as the features and principles of generative objects in this chapter, I have developed design toolkits to enhance children's material study in their primary education and to enable them to also be applied to professional design practices. In addition, the characteristics of design activity have formulated the structures of pedagogical practices, *Tangible ideation*, which will be discussed in Chapter 4. This structure will also be revised and discussed in depth in Chapter 5. Furthermore, the guidance and challenges discovered in this chapter will be synchronised with the findings from other practices working with children and discussed together with the designer's roles in Chapter 6.

# 3.1 Ethnography and children's involvement in research and design

Design is future-oriented, and anthropology has an interest in social change and people's imagination of the future. Design anthropology – as the social science based on empirical research in cultural contexts – is a fast-developing domain combining elements from design and anthropology. Design and anthropology have been conjoined through ethnography.

However, social science often lacks tools and practices to actively engage and collaborate with people and their future (Otto & Smith, 2013). Moreover, the adopting of theories and methodologies from social science to design can be challenging in its appropriation and adequateness in different contexts and settings.

In the study of childhood or children, traditional research methods have often been applied, such as field observations and interviews, to examine children's lives, activities and experiences from an anthropological perspective (Wyeth, 2006). In these studies, ethnography has been praised as being one of the most effective methodologies to study childhood (ibid.; Levine, 2007). Ethnography has been defined as describing a group of people, its institutions, interpersonal behaviours, materials productions and beliefs (Angrosino, 2007). According to Dourish (2006), ethnography refers to stories about people, and the ethnographer is someone, who tells a story about people. Hence, depending on who is telling the stories, there might be different perspectives between the members and the ethnographer. The research is based on real stories in the setting of the members' environment rather than in laboratory settings. Thus, it is important to consider and respect the group member's perspectives and experiences.

Children are aware of their own views and experiences (Lee, 2017a). Understanding these experiences, structures and attitudes in childhood might be limited for adults as well as challenging; therefore, children need to perform as social actors as a medium through wihich to access other children (Alderson, 2008). Nevertheless, adult researchers have considered the value of children's voices by encouraging them to express themselves as also seen in Alderson (2008). However, when adults conduct and report on children's research, we need

to be aware of increasing the hazards of token involvement and of misreporting children's viewpoints (Hart, 1992). By enabling children to be fully involved, we advance towards respecting children's right (UNCRC, 1989) as well as allowing new directions and possibilities for research and designing *for* and *with* children (Lee, 2017a)

As mentioned earlier, ethnography and PD have shared principles. According to Blomberg and Karasti (2013), ethnography provides sources to understand moments and situations at hand, and inform backgrounds of the situations in design as a component of PD methodology. However, ethnography and PD have distinctive principles: the former is based on everyday settings, including artefacts and activities, holistic views, descriptive understanding and the members' point of view; in contrast, PD focuses on mutual respect for different knowledge, opportunities to learn about another domain of knowledge, joint negotiation of project goals, as well as developing tools and processes to facilitate design (ibid.). Furthermore, ethnography and PD have slightly different time frames and foci: the former studies current moments and the latter focuses on producing future scenarios based on current activities (**Diagram 5**).

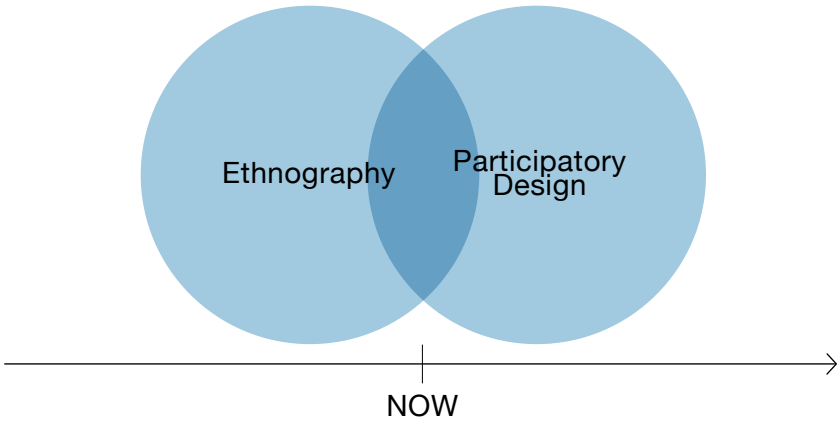



Diagram 5. The different time frames between Ethnography and PD.

Ethnography provides background and provided activities from PD directly engage participants in design. Consequently, reflection and intervention are essential in both ethnography and PD. Ethnography leaves space to support interdisciplinary learning and reflexivity toward the future of PD and its relation to ethnography (Blomberg & Karasti, 2013).

## 3.2 ARKKI session

As the first design ethnography, I conducted an observational study in ARKKI (Lasten ja nuorten arkkitehtuurikoulu, in English School or Architecture for Children and Youth) during the spring term in 2012. This investigation aimed to understand children's interests and perspectives through their outputs and conversation during activities among children and adult teachers. Four different age groups were arranged, and each group was labelled in alphabetical order for further analysis. The first three groups had sessions on Monday, and the last group had sessions every Thursday. All the group sessions were allocated different timetables, and each session lasted one and a half hours.

A. 7–9 years (11 participants, in English, every Monday 15:30–17:00),
B. 10–13 years (6 participants in English, every Monday 17:00–18:30),
C. 10–13 years (9 participants in Finnish, every Monday 18:30–20:00), and
D. 4–6 years (6 participants with their parents in English, every Thursday 17:00–18:30).

I participated in 23 sessions totalling 34 and a half hours during this period. As an assistant teacher and a participatory observer, I investigated designerly and architectural projects with the children. I collected data by documenting field notes and visually recorded interesting moments through photographs during the session. The collected data required approximately seventy hours of analysis after the fieldwork. During this research, the children revealed their thoughts, perspectives and interests through physical outputs created by themselves. The conversation between the adults and child participants brought a thorough understanding and new insights supporting the observations made during the studies.

## Initial findings

From the children's designerly and architectural indoor activities, the observation provided not only new insights into children's distinctive developmental features according to different ages, but also evidence to confirm these features. In particular, this investigation has constructed the grounds of focus for this entire research. I have listed the initial findings from the first observational study below:

1. ***Shape and Function:*** There were two significant characteristics concerning form and function. First, children's perception of the notion between form and function differed from adults' notions. This aspect had already surfaced several times in my earlier experiences, for example, in Episode 2 in the Preface Chapter. Form follows function is a well-known principle in architecture and design by Louis Sullivan. Compared with this principle, the children adapted functions based on the forms of the objects. However, this trajectory could be distinctively found by different agedgroups of children. However, younger children tended to rely on applying readymade objects more often than older children. Secondly, I assumed that circumstances might affect children's preference. For example, a few children liked striped patterns (i.e. three out of five). These were one of the characteristic features of Marimekko, which is an well-known fashion and interior design brand in Finland, where this first observational research was conducted.

2. ***Materials and tactile awareness:*** Various materials provided more opportunities for the children to develop their ideas. The shapes and textures of ready-made objects rapidly and effectively guided the progression and development of children's ideas. The children were aware of different feelings between warm and cold. Based on this distinction, they could choose different colours, shapes and materials according to their temperature. In general, the children were interested in new materials, which they had not experienced earlier and materials from nature. Indeed, the children were most interested in mixing and creating new colours.

3. *Scale, dimensions and space:* Adjusting the scale between objects and the environment was a very challenging task for the children. During many of the projects, the participants built scale-models; therefore, they needed to compare the scales between different objects and spaces. This task especially required the intervention of adults with the children's inquiries. Overall, the children preferred working on a real scale (1:1) rather than miniatures. As a quick and handy approach, measuring with the body appeared to be a practical approach, particularly with younger children, who were unable to understand measurements and units. In addition, the notions of two-dimension and three-dimension were converted on some occasions depending on the children's age. For example, several children combined these two distinctive dimensions in their drawings as well as in the modellings. Furthermore, many children created hidden and adventurous places, such as a cave or a pulley in their modellings. This trajectory is likely associated with children's imaginative and creative games.

4. *Social issues and collaboration work:* The children were aware of and discussed environmental problems, ecological suggestions and saving energies. Many of the projects initiated from current phenomena and some of the projects were operated as collaborative works. Most of the children cooperated well with their peers, and an interesting procedure was observed during the collaborative projects. In the pairgroup, the two children worked equally hard and balanced the power relationships. In contrast in larger groups with more than three children, one child naturally became the leader of the group with the others becoming the subordinated. In addition, some children switched roles during the work process.

5. *Child development and behaviours:* During the session with different age groups of children, I explored the differences between child development and behaviours. The four- to six-year-old children were already adept at cutting objects with scissors: they were able to cut exact lines accurately. Two par-

ents commented that their children enjoyed cutting rope, clothes, hair and even grass. In addition, the children also revealed distinctive difficulties and challenges among different ages. Many of the children were at first hesitant whilst becoming accustomed to these unfamiliar situations. This might be related to their earlier experiences. They were notably confused between fantasy and reality on some occasions; nonetheless, the older children adapted reality more closely and frequently than the younger children. The 10- to 13-year-old children explained their ideas through graphic and written description. Compared with this group, the younger children relied on more graphic descriptions when they revealed their ideas.

After the first ethnographic study, I understood children's interests and perspectives through their outputs and conversation during activities as well as investigated children's distinctive developmental features according to different ages. However, the research setting limited research validity since all the activities were conducted in indoor settings and the group of children were mostly privileged participants, who had previous experiences of designerly and architectural activities. To overcome these limitations, I considered conducting another ethnographic study in an outdoor setting with children, who processed less designerly and architectural experience. For these reasons, I arranged a second observational study focused on children's outdoor activities.

## 3.3 Hut-Building

*Hut-Building* is an observational study on children's outdoor activities. Here I argue for the evidence and importance of design ethnography as a way of engaging motivation and participation of children in PD. Based on the positioning ethnography within PD by Blomberg and Karasti (2013), I later adapted the position of ethnography particularly within PD with children. This part has been written based on my publication, 'Built together: an observational study on outdoor activities engaging children in design', in the proceedings of the Cumulus Association Biannual International

Conference at the Hong Kong Design Institute, Hong Kong, China, in 21-24 November 2016.

## Settings

This second observational study was conducted at *Hut-Building* Camp, which was a type of summer school activity organised by ARKKI. It was held during weekdays for four to five days or a weekend in June 2012 in the forest of Espoo, Finland. The research was undertaken for 24 hours and documented with sticky post-its field notes, sketches, photographs, and video recordings during the event. The collected data required approximately 72 hours for analysis after the fieldwork. This fieldwork had no direct tendency in relation to HCI; however, I followed the general procedure and structure of ethnography when applying it to this domain: 1) selecting the study group, 2) choosing participation, 3) initialising contact, 4) building relationships with the group, 5) collecting and analysing iterative data, and 6) reporting the results (Lazar, Feng, & Hochgeiser, 2010). After investigating the initial findings from the fieldwork, I examined any interesting phenomena and provided evidence for further design opportunities. The new design opportunities will be discussed at the end of this chapter.

The event invited seven- to twelve-year-old children both from Finnish and international backgrounds. Forty children participated in the event, and were divided into five different groups based on their ages and the former hut-building experiences. One group consisted of eight to ten children, and one or two adult instructors. During the session, four groups were instructed in Finnish alongside one in English. As a participatory observer and assistant instructor, I carried out ethnographic observation during the event and participated mainly in the English group due to the Finnish language barrier; nevertheless, I also included some observations on the Finnish groups during the period. I observed, interviewed and interacted with the children and adult instructors. During the event, I thoroughly sought to maintain a balance between the roles of participant and observer.

To build a productive workflow, I visited the campsite as well as became familiar with the environment and participants well in advance. On the first day, I visited the camp location to become

acquainted with the children rather than collecting data. I introduced myself to the children and explained the research as well as requested permission to photograph and video them. This procedure was purposely included despite having already received authority to conduct this research from the organiser, who had obtained consent from the children's guardians. It was an essentially required procedure to ensure the children would feel more comfortable and willing to interact with me during the research. Furthermore, the semi-structured interviews were conducted with the teachers, but not with the children. I have adopted the idea from O'Kane's approach (2007) leaving the children to choose when talk to me once they felt comfortable around me.

During the event, children built different types of huts: tepees, tree houses, tunnels and dorms under the instruction of the adult leaders. I mainly jotted notes on sticky notes about matters concerning the participation, collaboration and creativity of the children, as well as drew sketches to capture the process of the event. I used a post-it to write my field notes since they were portable and a simple manner to document observations (Emerson, Fres, & Shaw, 2011). However, these notes were created in a great rush within a limited frame of time; thus, a partial rewriting of the memos was required after the event. All the materials utilised during the fieldwork were categorised into specific issues. These rewritten notes were arranged by chronological sequences and into actions. In addition, I recorded interesting moments through photos and videos. However, the recorded data were secondary materials collected mostly to aid in recalling the event. The primary approach of the study was active participation to obtain a thorough understanding of the circumstances.

In the focused group, there were three boys and seven girls, who were eight- to eleven-years-old. The participants used English as the common language in the group due to their various cultural backgrounds. I was engaged as a participant researcher and an assistant instructor, and the primary adult instructor in the group was a former student of the event organiser. After introducing each other, all the participants began the session with the instructors writing down the children's names on the sticky tape attached to their vests.

## Gathering data and initial findings

Since this study was an experimental case of working with children in an outdoor setting and engaging them in natural conversations throughout the process, as a designer and design researcher, I had opportunities to meet children and access their natural environment. The collected data, the fieldnotes (ABL Memo 3, 2012) and photos, themselves were analysed with an affinity diagram (ABL Affinity diagram 1, 2012) to initiate categorising the activities and significant elements during the event (see Appendix 3). The sketches and photos were synchronised to comprehend the whole process of different building activities. Based on these collected data, I listed the procedures of building tepees and tree houses (**Image 5–18**) below.

**The building process of a tree house:**

1. Look and decide on an appropriate spot between the existing trees for a tree house.
2. Measure, select and cut branches for horizontal supports between the existing trees.
3. Connect them to the trees with square knots.
4. Make relevant accessories: such as fences, floors, stairs, and climbing ropes.
5. Connect to other elements, such as reed tunnels, dorms and other tepees and tree houses.

**The building process of a tepee:**

1. Select three birch branches for the main structure of a tepee and place them with gaps of 120 degrees each on the ground. Leave gaps between the branches and tie them with ropes.
2. Tie one thick rope in the middle of the linked site and pull the thick rope to raise the structure. Then make a triangle shape with three branches as the main structure and rearrange all the vertical structures in the equal distance.
3. Measure, select and cut five to six branches for horizontal supports of the main structure. Then, connect them to the vertical composition with square knots.

Image 5. Holding tree branches; Images 6–9. The different activities during the hut-building event.

Images 10–18. The different activities during the hut-building.

4. Cut and place wooden panels to form a floor and secure the wood panels with nails and by using a hammer.
5. Make a ladder to climb up to the second floor.
6. Measure and select a short branch for the structure of a fence Then connect them to the vertical structures with square knots.
7. Measure and cut wood panels for the fence.
8. Secure the wooden panels with nails using a hammer.

One of the most critical impressions of this whole event resulted from an unexpected situation. Indeed, my expectation before the fieldwork began did not fully match the observations. Although the research manifested significant findings on the children's perspective of materials, nature and games, the built huts were not initiated from the children's ideas during the camp. In particular, the focused group (international) in which I participated demonstrated a tendency to be pessimistic. Compared to other groups in the hut-building event, the group was mostly unmotivated, less participatory and collaborative, and seemed to be more adult-directed. The children in this group were not motivated to engage in the goals of this event; therefore, they lost some interest in it. The children constantly complained about their boredom; for instance, one boy asked several times when he could stop working on the hut-building activity. Moreover, some of the children did not appreciate the activity and passively participated in the process.

Although the video recording data were counted as secondary materials collected mostly for remembering the event, I recorded one scene when the young participants built a tree house with the adult instructor in this group, and transcribed it after the event. The transcription has been attached as Appendix 4. The reason this scene was of such significance was that this revealed an unpleasant atmosphere in this group during the collaborative building task. Several reasons might explain the tense and unpleasant mood.

First, the primary adult instructor forced the children to work without a break. Secondly, the building process was complicated for those children who were without previous experience or knowledge; therefore, the children who had no experience of this type of activity might have felt uncertain and at a loss. Thirdly, the children did not achieve adequate bonding with their group members. Fourthly,

the language might be one of the barriers to forming close bonds in this group: the children were instructed in English, which was not the children's native language. Consequently, the children possessed different building experiences and they lacked opportunities due to social and linguistic barriers preventing them from bonding with their peers and adult instructors.

At the tree house building scene, some members in this group had already lost their interest and motivation in this task. They did not appear in the video because they had already wandered off or stopped participating in the activity. Regarding the earlier research materials, the video recording materials only captured a few interesting scenes rather than recording the whole event. For this reason, the video record solely described a partial view of constructing the tree house. Hence, a written description was relevant to support explanations of the contexts and situation. I have already mentioned above the process of building the hut, below I describe the participants' locations and behaviours, as well as the setting of the activity focusing on the process of building a tree house.

1. ***Choosing a site:*** The adult instructor requested children to gather around her and explained that they were going to build a tree house. She then asked children to find an appropriate site between the existing trees to build the house. She suggested a couple of options from which to choose trees and the location. Some of the children in the group agreed on one site. However, the children did not immediately answer. Instead, they agreed with the instructor's suggestion or followed a suggestion decided on by other children.
2. ***Measuring and preparation:*** The instructor divided the group into several pairs and asked the pairs to bring timber. Each pair brought the wood to build a tree house. The instructor demonstrated the procedure to measure the distance between the trees, and the measurement to cut the wood for horizontal supports between the trees. When the children separated from the group, it was then difficult to gather them again. It demanded time and effort, such as commanding each child by name to come.

3. ***Cutting the wood:*** The children were requested to cut the wood based on the measurements. Whilst some of the children cut the wood, other children went to different places and tried to find other games to play. The children who were working on the assigned tasks participated in the activity. On the other hand, the other children who were not working on the tasks showed a lack of interest and attention. Soon they tried to move away from the working site and find something else to do. The children disliked waiting for the allocation of roles and times.
4. ***Tying elements:*** Connect them to the trees with square knots and add accessories, such as fences, floors, stairs and climbing ropes.

There were only three children positioned at the building tree house site when the video was recorded. **Diagram 6** has depicted the setting, including participants and four different building features, such as two tree houses (A: building tree house spot and C: another three house) and two huts (B: the focused group's hut and D: another group's hut). Namely, the targeted group was building structures (A) and (B) and another group was building structures (C) and (D). In the diagram, the adult instructor has been marked as (I1), and the participating children were labelled from (C1) to (C9). The other children were around the site, but they did not work on building the tree house.

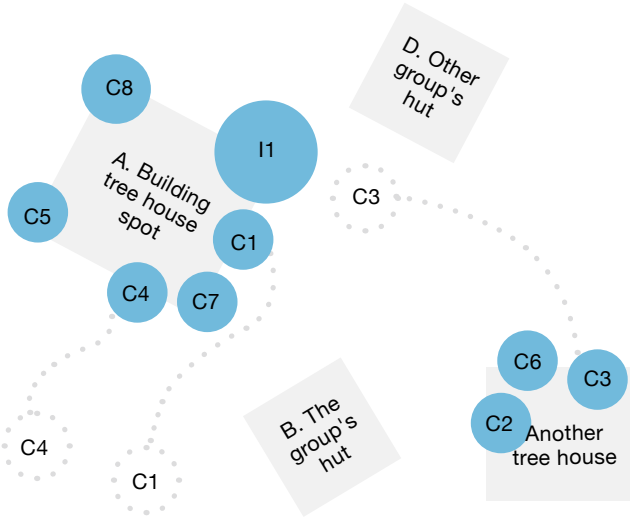



Diagram 6. The position of building features and participants in the focused group.

Working procedures were similar among the different groups in this activity; however, the working processes might have differed between each group. For instance, the focused group was building the tree house whilst I conducted the observation, whereas another group had already completed their tree house.

During the tree house building, the position of the children changed in the focused group, and I have marked this change with dotted lines on Diagram 6. In the beginning, three children were shown to be at the building site in the video. Later, the adult instructor tried to involve more children during the building activities. She first generally requested children to participate in some tasks, but then she immediately pointed to a child calling them by name. One child (C3) was playing with a rope near the building tree site, and then she was requested by the instructor to confirm the parallelism of the component from a distance; therefore, she needed to move closer to another group's tree house. However, after confirming its position, she did not return to her assigned work site. There were two other children were already seated on the tree house (C) built by another group, and they individually occupied themselves, rather than collaboratively. They occasionally observed other group members' building activities or listened when the instructor spoke.

The video documented the children and one adult instructor building the tree house during one minute and fifty seconds. According to the time frame, I marked the interaction points between the participants. The marks were categorised between verbal communication and action. In many of the cases, the adult instructor mentioned the types of instruction to build the tree house, after which, some of the children reacted based on the instructions. There was not much independent work among the child participants. They just followed the instructor's commands or instructions. Moreover, some of the children tried to escape from the building site. First two, later three children (C2, C3 and C6) just acted as bystanders, for instance, by sitting on the other tree house a slight distance from the building sites. In addition, they did not want to continue to join in the building activities (**Image 19**).

Image 19. The three non-participating children.

One child (C5) worked independently tying branches with rope. It seemed that she was quite confident carrying out the task. However, she tended just to repeat these same motions. Another child (C8) was mostly positioned on the top of the building structured as requested by one of the instructors to adjust the balance of the main structure. However, this request seemed unreasonable for such a long period especially as the child was afraid of being up there because of the height.

One boy in the group (C9) could not be found on the working site; therefore, this boy has not been shown in Diagram 5. During the whole period of the event, the boy hardly participated in the building activities. Later, he was found in another group's hut seated on the floor creating an object out of a wooden stick with a knife. He was purposely in hiding as he wished to create his object using a tool (the knife) and decided to begin without adult consent or supervision (**Image 20**).

Image 20. Non-participating child in the collaborative task (Lee, 2017a).

## 3.4 Focused analysis

From the initial findings, I focused on more specific aspects in terms of children's play, their interests, motivation and disengagement, as well as the roles of participants and children's relationships in groups in a more in-depth analysis. Through this analysis, the initial findings can be articulated with possible design opportunities for and with children. For instances, the process of building relationships with children was a relevant response to children's expressions as well as encouraging children's motivation, participation and collaboration to guide them to improve the processes and outcomes.

### Meaning of children's play

Adults have occasionally misinterpreted and misdirected when designing artefacts for children, such as in the case of Lego's ethnographic research by Future Lab to recover from their decade of economic recession (Ringen, 2015). The study also verified the importance of

the basics: the meanings of play. Tassoni (2006) has described free-(unstructured-) play as child-initiated activities, and structured-plays as adult-directed activities. Free-play or child-initiated activities support children with setting their goals, maintaining long periods of concentration, creativity, responsibility, learning to choose, gaining confidence, and mastering skills. On the other hand, structured-play or adult-directed activities support children's learning curriculum, as well as gaining specific vocabulary and skills (ibid.).

However, the findings from the field study demonstrated that structured play differed from adult-directed activities. Children initiated and played the existing structured play by themselves based on their motivation. For example, the children actively played the game, Redlight & greenlight during the break in the event. In this game, one person has the role of 'tagger', and the others' task is to try to touch him/her. In the beginning of the games, all the children form a line about 5 m from the tagger. The tagger faces away from the line of players and says "Greenlight". At this point, the players are allowed to move towards the tagger. At any point, the tagger may say "Redlight!" and turn around. If any players are caught moving after this has occurred, they are out, or they need to hold hands with the tagger, thus joining him/her. Play resumes when the tagger faces away from them again and says "Greenlight". The tagger wins if all the children are out before anyone can touch him/her. The first player to successfully touch the tagger wins the game and earns the right to be the new tagger for the next game (Nieboer, 2011). In Finland, this game is called 'Peili', which means 'mirror' in Finnish. In comparison with 'Red light & green light', the tagger and other children do not say a word. Rather they act without any words. In Korea, this game is called 'Moo-goong-hwa-kkot-i-pi-eot-seub-ni-da', which means 'the altheas have bloomed'.

It was interesting to observe this game which all the children intuitively knew how to play despite their different cultural backgrounds. Therefore, when one adult instructor joined the children in the game, she held an equal role with the other children. However, she intervened if any children encountered any difficulties or conflict during the game.

In this study, the children demonstrated different outdoor activities. Consequently, I categorised the activities as being child-initiated

and adult-directed, rather than free-play and structured-play due to a wish to highlight children's initiatives. These findings were also closely associated with children's interests and motivation.

1. ***Child-initiated activity:***
   - Climbing huts, tree houses or ladders
   - Hanging ropes
   - Swinging
   - Creating toys, such as archery bow, guns, swords, or arrows
   - Playing Red light- greenlight
   - Playing with balls
   - Digging a fireplace
   - Building task during the break period
2. ***Adult-directed activity:***
   - Calling on children by name
   - Carrying timber and working materials
   - Cutting wood
   - Holding structure
   - Tying the structure with rope
   - Weaving a reed carpet
   - Making a caution sign
   - Hiding and finding treasure
   - Measuring timber

## Children's likes vs. dislikes

Children are innately curious and interested in many different things. During the Hut-building event, I listed children's likes and dislikes. The participants showed great passion for new materials, tools, actions or tasks. They were keen to engage in a physical form of play, such as climbing, jumping and hanging (**Image 21**). For example, they occasionally swung on the ropes performing different types of swings, as well as sometimes excitedly creating their toys (**Image 22**).

Image 21. A physical form of play (Lee, 2017a).

Image 22. Creating the toys and plays (Lee, 2017a).

In particular, the boys tended to be enthusiastic about making bows and arrows, as well as gun-types of toys with actual tools, such as hammers, nails, saws and knives. For safety reasons, the adult instructors needed to pay careful attention to the boys, who had and played with these types of toys. However, the children were aware of the safety issues. They created warning and caution signs themselves (**Image 23**).


Image 23. Warning and caution signs created by the children (Lee, 2017a).

This activity indicated that children demonstrated to the authorities some responsibility for their initiated outcomes. Ensuring the children's safety was important, but it was more relevant to teach children to aware of and be responsible for it (Lee, 2017a).

Three young participants were interested in capturing the outcomes or moments, which they were proud of and willing to show. One boy wanted to be included in the photos, and he also photographed some of the huts with his mobile phone. He expressed pride in his work and showed enjoyment during the conversation. As another example, two boys created a wooden sign and crossed bridges carrying it. They read the word on the sign whilst they were recorded on the video. They repeated the word as they shook the sign displaying their pride in their creation. In contrast, the children lost interest in iterative tasks or processes, such as tying the structure with rope, holding structures and weaving reed carpets. However, the iterative tasks with tools lasted for a slightly lengthier period compared with the other tasks without tools. These unpopular activities discouraged children and reduced their motivation (Lee, 2017a).

1. ***Children liked:***
   - Physical play such as climbing, jumping and hanging
   - Natural materials
   - Using tools (hammers, nails, saws and knives)
   - Photographing
   - Being photographed
   - Being videoed
   - Cooking (pancake, sausage)
   - Food (popcorn, sugar, ketchup, jam)
   - Hiding and finding treasure
   - Big scale (real scale)
   - Writing signs on the panel
2. ***Children disliked:***
   - Tying the structure with ropes
   - Holding the structure
   - Weaving reed carpets
   - Iterative tasks
   - Walking for long distances

The constant work was challenging for young children; for instance, the children became tired of the weaving, tightening and holding up parts of the building structure. In contrast, they indicated their interests in new tasks, but they also became easily tired and bored with them eventually wanting to escape from the work. They were more enthusiastic when working with tools, such as cutting wood with saws and hammering nails. To overcome this, the primary adult instructor in the English group emphasised a constant working process rather than outcomes. She mentioned that outcomes were not important, it could be anything and adult instructors had to teach children to carry on working. There was no doubt of the importance of the learning process rather than results. However, it was difficult to persuade children to work consistently when they did not have the motivation and desire for it.

The children indicated great enthusiasm for cooking, for instance, with grilling sausages and frying pancakes. Occasionally, they were more interested in cooking than in the food itself. Instead, the children were more concerned with the size of the built structures. They compared the size of their tepees with the outcomes of the other

groups. They expressed disappointment if their tepee was smaller than others (Lee, 2017a).

## Role of children and adults and children's relationship in the groups

The participants were occupied in various roles during the whole event. First, the children learned the methods with which to build natural huts participating in it as builders and makers. They created their toys and games as well as chose their roles in the games. Some children acted more as onlookers, rather than active workers. The adults organised the camp and instructed children on the hut-building procedure. They guided and supported children during the building process. In addition, the adults cooked for the children and served them the food.

The adults occasionally tended to order the children about, thus forcing the children to follow orders. This behaviour was not conscious, but it frequently surfaced between the adults and children when they were working together. On this occasion, the adults could defend their behaviour by resorting to explanations of learning purposes and leading outcomes. However, the relationship and interaction between adults and children needed to be balanced between simply sharing instructions and enforcing them.

The observed group members displayed weak bonding as a group. Some of the children had participated in other courses organised by the same organiser before this event. Additionally, the primary adult instructor did not seem to have previously built a relationship with the children in the group. The children mostly relied on their previous relationships; for example, the children spent time with their friends with whom they were already familiar. It was difficult to find any improvement or increase of closeness among team members, even after five days of working together.

I presumed several reasons were the cause of the group's weakened relationships: 1) mixed nationalities, 2) less in common, and 3) differing motivation. These reasons correlated with each other. Diverse cultural backgrounds were represented among the children, such as Finnish, Italian, Korean, African and Hungarian. Therefore, English was naturally the main instruction language. Each child possessed varying degrees of

English proficiency, resulting in the communication being less fluent than it would have been in their respective mother tongues. These different cultural backgrounds also meant that the children potentially had less in common, in addition to which, they also had varying degrees of building experience. At least two girls (C3 and C4 on Diagram 5) had participated in the same hut-building camp the previous year. Another two girls had prior experience in indoor building activities. Although a higher competency in the building might have encouraged the children to participate more or motivated them to engage in the activity, it also depended on the child (C6 on Diagram 5).

Children in the other groups were mostly Finns; therefore, their primary and common working language was Finnish. Many of the young participants already knew each other in terms of attending the same schools or the same after-school activities. It was not comparable with each group, including child participants and adult instructors, but I thought that other groups tended to display more active and participative attitudes during the building activity. For instance, some of the children from one group wished to continue building huts and tree houses even during the break. In addition, the adult instructors in the other group seemed to more gently instruct their children. It has been rigorously proven that the close relationship already helped to create a positive and active atmosphere in collaborative tasks.

## Summary of the Initial findings

**Based on the analysis, I list the initial findings below:**

1. Material experience: The children were interested in natural and novel materials. However, some children disliked touching them and were not as willing to touch dusty and muddy materials.
2. Play, tools and safety: The children were keen on physical play creating their toys, and using real tools and games. They also understood the importance of safety in this context.
3. Process rather than results: The children focused on creating their own game and the equipment process, rather than its outcomes.
4. Comparison of results: The children compared the look of

their huts with other groups'. In particular, they concentrated on comparing sizes rather than features, such as functions, materials, and structures.

5. Motivation from competence: The children were more motivated to proceed when they possessed some degree of competence. Less competence along with an iterative work process decreased the children's attention, interests, and motivation.
6. Different levels of collaboration (adult-initiated collaboration, child-initiated and directed collaboration, children-initiated and directed collaboration): The children experiencing initiated and directed collaboration displayed high motivation and pleasure.
7. Building a difficult relationship: Constructing trust in others helped to decrease the children's fear and to collaboratively achieve task completion.
8. Leave children to do as they wish: The children had more motivation to tell, work, and express their thoughts when they were free and comfortable.
9. Procrastination: The children tended to refuse and procrastinate on iterative tasks and work in which they had less confidence. They were willing to unburden themselves of it and pass it onto others.
10. Fewer chances, less motivation: The children lost motivation when they had less opportunity to choose. Nonetheless, it did not mean that limited sources were linked to reductions in the children's creativities.
11. More enthusiasm for personal creation: They were keen to create their toys with natural materials. They wanted to show and explain the outcomes.
12. Increasing authority and enthusiasm: The children were able to build authority and encouragement through their creations (Lee, 2017a).

# 3.5 Learning from Ethnography toward Participatory Design with children

From this observational study, I have pointed out three key learning: children's collaboration, building relationships, as well as relations between competence, motivation and participation. These acquisitions support transiting a mind-set from ethnography toward Participatory Design (PD) with children.

## Children's collaboration

From the *Hut-building* study, I discovered different levels of children collaboration: 1) adultinitiated collaboration; 2) child-initiated and directed collaboration; and 3) children-initiated and directed collaboration.

1. Adult-initiated collaboration: Adult-initiated collaboration between children occurred during work on given tasks, such as carrying materials, holding up structures or tightening components. To achieve the set tasks, the adult instructor needed to encourage collaboration among the children. In this instance, the children had less motivation and no desire to work.
2. Child-initiated and directed collaboration: Child-initiated and directed collaboration were found in the example of the children's weaving task. One girl compared both sides of the weaving task, and then she asked her friends to work on one side, which had been operated on less; thus, she wanted to balance the outcome. The children participating demonstrated a little more motivation and enjoyment.
3. Children-initiated and directed collaboration: The children-initiated and directed collaboration simultaneously occurred among the children and spontaneously continued. It demonstrated high motivation and lasted for more extended period with more pleasure compared to the other collaborations (Lee, 2017a).

## Building relationships

As noted earlier, the observed group did not display signs of having formed a close bond as a group. Some children had participated in other courses led by the same organiser of this event. However, the primary adult instructor had not formed ties with the children. Instead, the children mostly relied on their previous relationships; for example, the children socialised with their friends, rather than attempting to form new ones. Hence, any improvement of closeness among team members was not perceived, despite the children working together for a week (Lee, 2017a).

On the other hand, the relationship between myself and one child improved somewhat during the event. The girl seemed shy and quiet; therefore, it was slightly challenging to interact with her at the beginning. The conversation began by us introducing ourselves to one another and naturally moving on to personal stories. I let her talk freely rather than interrupt by asking many questions. The contents of the conversation contained little that was remarkable or even personal; for example, she commented on topics, such as being bitten by mosquitos, her tiredness during the excursion, and her family. Our simple interaction was sufficient to form some temporary bond with one another. On the third day, she scribbled on a dirty piece of wood and presented it to me as a birthday present. This demonstrated the procedure of building a relationship between a child and adult through an ordinary conversation (Lee, 2017a).

In addition, it was interesting to investigate the way a child's fear and belief changed. During one situation, a girl had climbed up to the top of a tree house to help build the structure. Afterwards, she became aware of the height and was unable to descend. The adult instructors provided physical supports to help her to climb down, but she could not immediately accept that help. After several trial attempts, she accepted the help and finally climbed down. This sequence demonstrated that a child needed persons to rely on when she expressed fear or was placed in an unfamiliar situation. Without this initial trust between a child and adult, a child requires time to accept help from a strange adult. This further highlighted the need to build strong and persistent relationships between child and adult, and that it was an initial and vital step when working with children (Lee, 2017a).

## Competence, motivation and participation

To build a desirable relationship between an ethnographer and participants, it is essential to respect each other. Namely, adults should appreciate children by listening to their needs and desires and react accordingly. For instance, during the photographing and video recording, some of the children expressed an unwillingness to be captured on film. In this situation, the record would be immediately stopped if they showed any such desire. Nonetheless, some other children enjoyed having photos taken of them and their creations, and one child requested to see the photos and videos recorded during the fieldwork. In this situation, photographing and video recording would provide opportunities to continue the interactive conversation with child participants and receive feedback from them.

One child explained that she was not good at specific tasks, and she did not want to do them. On these occasions, the children worked with great enthusiasm when adults engaged with or encouraged them. They had considerably more motivation and excitement when they worked on a task for which they had some competence. Concerning the failure of collaboration between the adult instructor and children observed in this study, this research could provide adult designers and researchers with strategies for organising activities for children and working with them:

1. Deliver clear aims and goals for the activity.
2. Explain at the beginning the process holistically.
3. Explain the process step-by-step in detail.
4. Combine telling, showing and doing to deliver new information or instruction.
5. Define and allocate children's roles
6. Encourage children to experience different roles.
7. Be patient in waiting for children to answer and react.
8. Balance out child-initiated activities (free-play) and adult-directed activities (structured-play).
9. Applaud and encourage children.
10. Do not overwhelm the children with a surfeit of new information or instruction all at once. (Adjust the procedure by

breaking it into smaller steps according to children's previous experiences.)
11. Do not order children about.
12. Do not pressure children when they express their unwillingness and a lack of motivation.
13. Do not ignore children's difficulties and conflicts (Lee, 2017a).

It would appear that this study provides evidence for the best approach for working with children, as well as information on less helpful approaches (Lee, 2017a). One of the most significant findings concerned the social setting and factors for success or failure regarding motivation and inclusion depending on certain factors; for example, activities that the children liked or disliked mentioned in this dissertation could be regarded as a step for understanding which features can be practically used to encourage or discourage children in PD sessions. Furthermore, the abovementioned tips could guide planning activities in PD sessions with children.

Although the research revealed significant findings on the children's perspective of materials, nature and play, there were some difficulties and limitations conducting the study: balancing the roles between being a participant and a researcher, insufficient expert knowledge on building huts, language barriers (Finnish) and time limitations. Moreover, examining the children's collaboration was restricted in terms of the circumstances of the group task. The children possessed more opportunities to work and talk with peers in the same groups. Hence, this study needs to be further extended (Lee 2017a).

From this hut-building observational study of a children's outdoor activity, the initial findings could be implemented for design cases both for and with children. Young people are naturally interested in natural materials and enthusiastic about creating their toys and games. This natural interest provides opportunities for tactile and sensory education as well as physical, natural and social play, which are essential to children. However, the second study did not cover the scope of developing materials enhancing hut-building learning. Instead, I focused on exploring material matters within designing with children as well as developing generative material study approaches and toolkits for children and youth. Learning through play is one of the long lasting

teaching and learning approaches. Further, this research emphasised the playfulness and intuitiveness of the materials. Even without guidance from adults, the kits should generate children's motivation to play and naturally connect with their learning to build experiences, similar to Lego's principle. Based on the findings from this study, material study approaches and toolkits for children are be developed in further studies (Lee, 2017a, 2017b) in Chapter 4.

*Learning* by doing is a popular and primary notion among all generations, which rendered it ideal for use in this observational study. Furthermore, a core principle of ethnography is immersing researchers in the world like a child who absorbs everything to learn the world (Crab, Rouncefield, & Tolmie, 2012). This chapter employed ethnography as the primary research method due to its iterative learning and reflective process (Blomberg & Karasti, 2013). The research was based on real stories in the setting of the children's environment rather than in laboratory settings. Hence, this research has thoroughly considered and respected children's perspectives and experiences. However, the two cases were arranged in particular situations, including special occasions and participants, despite the settings and activities being appropriate to explore the research objectives. To extend my research findings, further studies on materials study approaches and toolkits for children should be conducted in regular schools with various groups of children and different locations.

## 3.6 Key insights and progress in Chapter 3

Through this practice, I examined the designer applying ethnography in settings working with children. The practice expedited providing both adults and children with opportunities within the contexts of designing *for* and *with* children. These opportunities included essential features and relations among the three elements (people, artefact and activity) of ethnography. First, the adults provided children with opportunities to experiment with different activities. The children expressed their thoughts and perspectives through artefacts which they created. Through the created artefacts and conducted activities, the adults received opportunities to gain accessibility and a thorough

understanding of the children. **Diagram 7** has summarised the relations of the three elements of ethnography and extensive opportunities in the contexts of *for* and *with* children. Namely, the opportunities were provided at different levels with different directions among the people (children), artefact, activity and the designer. Thus, the role of the designer (i.e. design practitioner) could be considered in depth. Simultaneously, the designer has bridged gaps of understanding, respect and relationships between adults and children through ethnography, and this could provide the initiative and grounding of PD with children.

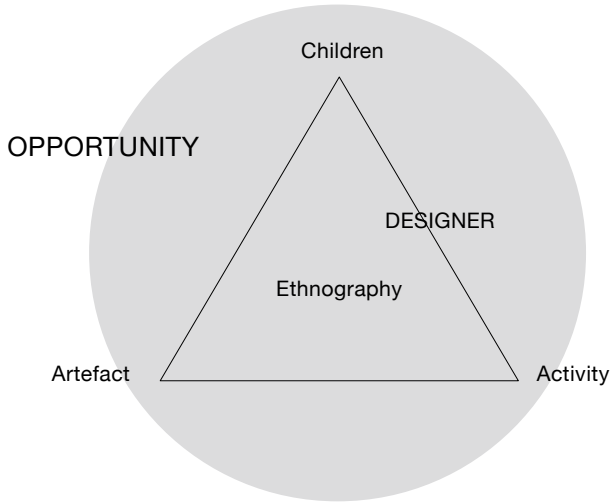



Diagram 7. Opportunities through ethnographic study in the contexts of for and with children.

# 4.1 Setting of the Material study approaches and toolkits

Children learn about new worlds, as well as express their thoughts and emotions through distinctive senses, such as sight, hearing, touch, smell and tastes. This interactive learning and corresponding procedures begin during the infant stages of child development: babies learn from and adapt to new environments, including individuals and objects through touching them with their hands and mouth. This similar, but modified, learning and experience through the senses has been applied to children's development and education. For instance, the Montessori approach encourages children to harness materials available in the surrounding environment to promote learning the world of objects through the sensorial qualities of materials, including smell, weight, colour, texture, sound and temperature (Morrison, 2007, as cited in Pedgley, 2010).

Another aspect to consider is the optimal avenue through which to analyse children's experience of this type of learning. One tool for this has been the analysis of their drawings to interpret their perspective and experiences (Piaget, 1970). Indeed, drawings have been used to capture children's views to develop computer programmes (Sheenhan, 2003). They have also been employed in the field of pedagogical research to gather data about students' experiences (MacPhail & Kinchin, 2004, as cited in Xu, Read, Sim, & McManus, 2009), as well as in the child-centred approach as an advantageous evaluation tool (Xu at el., 2009). However, not all children are confident when drawing. To investigate children's general interest, I conducted observational studies during children's activities in indoor and outdoor settings in Chapter 3. Supported by the initial findings from the preliminary research, many of the children expressed difficulties with drawing and exhibited low confidence during the investigation. In contrast, they were more comfortable and confident in handling tangible materials to embody their ideas.

Based on these early findings from the observational studies, I designed Material study approaches and toolkits with the intention of providing alternative ways for children to express and embody

their ideas. Inspired by the Montessori theory, many educational approaches have been developed to emphasise young children's tactile learning, which uses haptic sense through these types of tactile activities. However, there are few studies and toolkits focusing on exploring materials for school-aged children.

This research focused on children's materials experience (Karana & Hekkert, & Kandachar, 2008) and learning through hands-on activities. Pedgley, Rognoli and Karana (2015) have defined the materials experience in two different ways: 1) the experiences that people have with and through the materials of products, and 2) the knowledge and skills that designers possess if they are to 'design for experience' through the application of materials. Notably, this research aimed to develop children's materials knowledge, values and skills through active learning (Pedgley & Sener, 2017). Thus, I transitioned from a culture of 'imparting knowledge about materials' to a culture of 'generating experience with materials' as demonstrated by Pedgley, Rognoli and Karana (2015), and attempted to balance these two directions. In particular, I engaged in an empirical experience with materials by touching, manipulating, comparing, evaluating, and fabricating the materials, to contribute to the positive experiences of children (Pedgley & Sener, 2017).

This study contributes to fostering tactile learning and materials experience for school-aged children (7–18 years). To focus on the primary school children, five case studies were undertaken in their primary educational settings; however, this study has inclusively involved the older children (13–18 years) during the development of these approaches and toolkits. Therefore, although this study has intended potential implementation in secondary education and could be considered for future research, the focus and scope of this current study are within the primary education.

This aim of this practice, *Tangible ideation*, was for the design practitioner to develop design artefacts through activities with children and spontaneously teach children about designerly ways of thinking and skills in the primary school curriculum. These design practices were designed to demonstrate material study toolkits with different age groups of children (7–18 years). The participants had distinctive materials and cultural experiences in Case 4 *Organic architecture*.

During thes cases, the different toolkits and structure of activities evolved for different ages and based on the children's materials experience. Afterwards, this project adapted the structure to fit it into the context of primary education, and implemented it into the primary schools in Finland and South Korea from 2012 to 2014. The five cases were conducted in two main sessions: 1) a material exploration session: understanding and experiencing materials (physical substances), and 2) a design implementation session: designerly and architectural activities applied with material study toolkits and integrated into children's primary education. Through the active learning practices, the gap was bridged between 'knowing about' and 'experience in' materials (Pedgley, Rognoli & Karana, 2015).

Recently, the implementation and collaboration of design have been highlighted in diverse domains. In education, design enables an extensively practical and collaborative approach. Inspired by Lozanovska and Xu's and their work (2013) on children's participation in design, this research formulates pedagogical practices with children and explores the values of design in their education. I developed a pedagogical model and implemented design activities based on this model in the primary school curriculum. In this chapter, I present an overview and development procedure of designing the material study approaches and toolkits through those five different cases. I subsequently analyse and evaluate the provided approaches and toolkits in terms of children's developmental and educational merits. Furthermore, I discuss fine-tuning the approaches and toolkits for different aged of children, balancing the working atmosphere in activities with children, focussing on integrated teaching and learning, as well as considering cultural adaption.

## Designing material study approaches and toolkits

I recruited five different groups for the case studies. To develop the initial materials and increase its adaptability to a wide range of children, Case 4 *Organic architecture* was conducted over a long-term period in a special educational institute, ARKKI, with children of different ages. The main target age group of children was seven- to twelve-years-old, most of the primary school-aged children; nevertheless,

the study was extended to children up to eighteen-years-old for the potential development of the study toolkits for adolescents. Furthermore, three more cases were conducted for a short-term period in primary schools with fifth graders between Finland and South Korea (Cases 5, 6 and 7), and one case with second graders in South Korea (Case 8). A total of 107 children (Case 4: n=26, Case 5: n=26, Case 6: n=25, Case 7: n=26, and Case 8: n=25) participated in this project. Each group had different design inquiries in the implementation sessions after the material exploration (**Table 9**).

Table 9. An overview of the five different cases in this pedagogical practice.

| | CASE 4 *Organic architecture* | CASE 5 *Dream park* | CASE 6 *Build my city, Helsinki* | CASE 7 *Build my city, Seoul* | CASE 8 *Build my space* |
|---|---|---|---|---|---|
| Place and time | ARKKI after-school activity, Helsinki, Finland (Sep.–Dec. 2012) | Töölö Primary School, Helsinki, Finland (2 days, Jan. 2013) | Töölö Primary School, Helsinki, Finland (2 days, Jan. 2013) | Yeonhui Elementary School, Seoul, South Korea (1 day, Nov. 2014) | Kyodong Elementary School, Chungju, South Korea (2 days, Nov. 2014) |
| Participants | 26 (10: 7–9years / 7: 10–23years / 9 13–18years) Multinational backgrounds | 25 (10–11years, 5th grade) Bilingual class (Finnish+English) | 25 (10–11years, 5th grade) Bilingual class (Finnish+English) | 26 (10–11years, 5th grade) Korean | 25 (8–9years, 2nd grade) Korean |
| Period | 5–7 weeks | 130 min | 120 min | 90 min | 80 min |
| Sessions | • Material exploration<br>• Material implementation: Organic architecture | • Material exploration<br>• Material implementation: Dream park | • Material exploration<br>• Material implementation: Build my city, Helsinki | • Material exploration<br>• Material implementation: Build my city, Seoul | • Material exploration<br>• Material implementation: Build my space |
| Applied material study toolkits | • Frottages<br>• Collages<br>• Matrices | • Collages<br>• Palettes 1<br>• Matrices<br>• Image cards<br>• Sample kits | • Building blocks | • Collages<br>• Palettes 2<br>• Matrices<br>• Image cards<br>• Sample kits<br>• Building blocks | • Collages<br>• Image cards<br>• Sample kits<br>• Building blocks |

I organised and facilitated all the projects as a design expert, and the classroom teachers assisted in the projects. During this research, all the process and outcomes were recorded as photographs and videos. I additionally wrote down any meaningful conversations held with children and teachers during the sessions, as well as feedback from them afterwards.

**Figure 11** describes the distinctive characters of each material study approach and toolkits. These are based on the terms of primitive techniques from art and design, such as frottage, collage, palette and building model. They have been consecutively developed and evaluated throughout the development through the different cases rather than thoroughly planned before starting the project.

1. MATERIAL FROTTAGE

Frottage is the technique of rubbing an uneven surface to form the basis of a work of art. It is a suitable practice for touching or experiencing different materials and surroundings, especially for young children, who cannot explain and describe ideas in writing. The children are provided with papers and pencils with which to rub. Children initially observe and touch their surroundings. Afterwards, they rub on the surface of the surroundings or objects. The frottage shows visual depictions of materials and can be a piece of artwork itself (Image 24).

2. MATERIAL COLLAGES

Collage is art made by adhering various materials, such as photographs, pieces of paper or fabric onto a mounting board. It is a simple art activity without specific instructions. This technique facilitates children's materials experience through touching, cutting and gluing different materials whilst making the collage. The children also write down the names of materials as well as describe different feelings and uses of materials on the back of the collage, thereby also improving children's language skills (Image 25).

3. MATERIAL IMAGE CARDS

Each material image card represents on one side the image of a material or object found in daily life. There were two different material image card sets, including six different material types, such as fabric, food, material from nature, metal, paper and plastic. The children can write down the material names, tactile feelings and different uses of materials on the back of the image cards. It similarly improves children's language skills to the material collage (Image 26).

4. MATERIAL PALETTE BOXES

Material palette 1 is a cardboard paper box, which can store different tangible materials. The idea derives from the palette on which an artist lays and mixes colours. Children initially select materials from their surroundings without any other specific instruction or guidance. Children also collect some favourite materials from the material sample kits within this palette for other activities (Image 27).

5. MATERIAL PALETTE SHEETS

Material palette 2 is a sheet of paper on which children's favourite materials can be collected and described at the same time. Children describe names, tactile feelings and uses of the materials on the palette sheet. It shows children's fundamental understanding and previous knowledge of materials (Image 28).

6. MATERIAL MATRICES

Matrices in mathematics are a rectangular array of quantities or expressions in rows and columns that are treated as a single entity and manipulated according to particular rules. There are opposite adjectives in rows and columns, which describe tactile sensitivities of materials, such as hard, soft, natural or artificial. Children compare different feelings of materials based on the adjectives provided. This activity encourages children to create other tactile senses on the matrices and initiate practice with them. It improves children's language skills and comparison practice (Image 29).

7. MATERIAL SAMPLE KITS

Around 50 different objects represent different materials in the material sample kits. Children directly touch the materials, thus enhancing their materials experiences through the sample kits. Initially, the objects were found and collected by children from their daily surroundings. Based on the children's collections, the researcher replaced or added some items. However, the objects could be changed according to the circumstances or contexts (Image 30).

8.MATERIAL BUILDING BLOCKS

Building blocks are designed for constructing three-dimensional models. There are two different sizes made from two-millimetre thick cardboard sheets. Their dimensions are 45 mm by 45 mm with four grooves, and 90 mm by 45 mm with six grooves. Each side of the blocks has different material images or colours. The pictures on the blocks are adapted from the material image cards (Image 31).

Figure 11. The materials study toolkits 1–8 (Lee, 2016, 2017b).

Let it be noted that this research excluded foci on comparative studies among five cases. Instead, the study concentrated on several findings from each case in terms of adjustment and implementation for different cultural settings and age groups. **Table 10** describes the scope and foci of the respective cases.

In particular, the later five cases (Organic architecture; *Dream park in Helsinki; Build my city, Helsinki; Build my city, Seoul; and Build my space*) belonged to the pedagogical practice, *Tangible ideation* project. My research procedures were continuously refined through these five cases. Table 10 illustrates the scopes and foci of the cases as well as the development of the *material study approaches and toolkits*: the lighter grey cells present the aims of each case; the darker grey cells present the development of the material study approaches and toolkits. The *Organic architecture* workshop initiated the design and development of the *material study approaches and toolkits* for children. These approaches and toolkits have been implemented into the primary school curriculum in the Dream Park in Helsinki workshop. Therefore, the workshop constitutes an observation of children's collaborative working and decision-making in teams. This approach was adapted into a more compact version to ensure it would suit the primary school settings. In *Build my city, Helsinki* workshop, the building blocks have been primarily demonstrated in practice, whereas in *Build my city, Seoul* these material study approaches and toolkits were shown in Korean school settings. These two workshops indicate a few significant cultural comparisons. In addition, *Build my space* provides an opportunity to demonstrate the approach and toolkits with different age groups compared to *Build my city, Helsinki* and *Build my city, Seoul*. This promises research validity in different age groups of children and settings.

Table 10. The scopes and foci of the later five cases in Tangible ideation project.

| | CASE 4 *Organic architecture* | CASE 5 *Dream park* | CASE 6 *Build my city, Helsinki* | CASE 7 *Build my city, Seoul* | CASE 8 *Build my space* |
|---|---|---|---|---|---|
| CASE 4 *Organic architecture* | Case 4 *Organic architecture* | Developing the preliminary material study approaches to the primary school environment<br><br>Children's different awareness of materials and material preferences through the material matrices | | | |
| CASE 5 *Dream park* | Designing and developing the preliminary material study approaches | | | | |
| CASE 6 *Build my city, Helsinki* | | | Demonstrating the building blocks | Testing this approach in different cultural settings (Finland and Korean)<br><br>Comparative findings | |
| CASE 7 *Build my city, Seoul* | | | | Demonstrating the material study approach and toolkits in a different setting (Korean) | Providing this approach in different aged children<br><br>Developing the approaches and toolkits for younger children |
| CASE 8 *Build my space* | | | | | Demonstrating the materials study approach and toolkits with a different age group |

## Evaluating material study approaches and toolkits

This research presented *materials study toolkits* developed to enhance children's materials-experience and comprising knowledge acquisition, skills and context (Pedgley & Sener, 2017). According to the children's ages and their materials experience, I applied different material study toolkits described above and evaluated them. All the material study approaches and toolkits: *material frottages, collages, image cards, palettes, matrices, sample kits and building blocks*, were implemented according to children's understanding and experience of materials. The different material study approaches and toolkits were introduced and demonstrated. Each approach had significant characteristics because they were designed for different circumstances and targeted at different aged children. Through these experimentations, the children explored new ideas and experiences with these varied materials. Through these pedagogical material study activities, the children revealed their thoughts, perspectives and interest through the outcomes and discussion during the activities. To reiterate, the purpose of the five case studies was to evaluate material study approaches and toolkits with different age groups rather than compare the results between the respective cases. However, each toolkit has revealed significant characteristics, which needed consideration and elaboration in each of the studies.

In the observational study in Case 2 *ARKKI* observation, I found that many seven- to nine-year-old children had difficulties with writing. Hence, I employed material frottage, which could be adapted to any child in this age group to experience various materials without the necessity for mature writing skills. In general, the children enjoyed making their material collages after observing and selecting materials. Some children revealed a preference for certain materials, such as cardboard, metal, or materials from nature. Furthermore, the boys had more interest in collecting different types of materials, rather than focusing on certain types of materials; the younger children (7–9 years) also selected a greater variety of materials. However, the older children (13–19 years) chose fewer materials with which to create collages.

With the *material image cards* (3), which are no. 3 in Figure 11, the children participated in distinctive activities: categorising material

groups, selecting favourite materials, and describing the materials. This approach triggered in children a desire to talk about their previous knowledge of materials. Some children could not immediately select materials, despite their previously familiarisation with them. One issue that arose was the misinterpretation of a few images on the cards and the materials represented, or they chose to interpret them as being something else according to their own unique perception. The teachers commented on the material image cards being relevant kits for material study; however, the children first recognised the objects, rather than the materials on the cards. The teachers also commented on the need to include material names on the cards since the children occasionally asked for the name of the materials which were unfamiliar to them. The original image cards were designed with the names of each material; however, these had been removed to allow the children's imagination more free rein. For educational purposes, the names of materials will be more thoroughly considered later.

The pupils were requested to write down the names and descriptions of materials on the back of the material cards. If and when a few pupils did not recognise the materials at first glance, then the schoolteacher and I assisted them by explaining what they were. Some material images were unclear; therefore, they needed to be developed later (**Figure 12**). Whilst pupils described the materials in details, the majority of pupils used a minimal vocabulary.

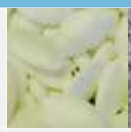
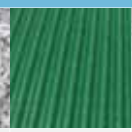
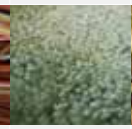
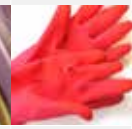
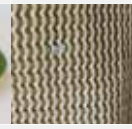
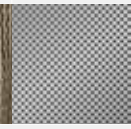
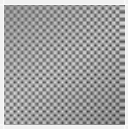
| GROUP | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| GROUP 1 | |  |  |  |  |  |  |  |
| | children | food | wood | metal | glass | plastic | plastic | plastic |
| | researcher | styrofoam | grinded paper | corrugated paper | china | stone | clay | soil |
| GROUP 3 | |  |  |  |  |  |  | |
| | children | twinkle | stiff | sand | tree fruit | tree | tree | |
| | researcher | laminated veneer | coloured hay | carpet | pressed paper | snow | paper dust | |
| GROUP 4 | |  |  |  |  |  | | |
| | children | from nature | rice | - | - | - | | |
| | researcher | corrugated paper | styrofoam | sponge | rubber | CD/plastic | | |
| GROUP 5 | |  |  |  |  |  |  | |
| | children | objects to fix or contain | | | | | | |
| | researcher | plastic container | plastic top | candle | corrugated paper | metal sheet | fabric | |
| GROUP 6 | |  | | | | | | |
| | children | plastic | | | | | | |
| | researcher | metal sheet | | | | | | |

Figure 12. Different recognition of materials by children and an adult researcher.

The participants had opportunities to experience diverse hands-on materials. The materials handed-out were mostly used to encourage an interest in studying them in learning and teaching occasions. The *material palettes* (4) had transitioned forms from two-dimensional to three-dimensional forms. First, the children had difficulties filling out the two-dimensional *palette sheets* because of a lack of knowledge and familiarity with the materials. Later, the palettes also transitioned into a three-dimensional shape as boxes with which to directly collect tangible material substances.

Through creating material matrices (6) with the material collages (2), the children could practise comparing different qualitative tactile experiences of materials. The outcomes varied; namely, some materials were placed in different positions by different age groups. For example, cardboard was separately grouped based on a variety of thickness, density, softness and hardness. These indicated the differing understanding children held of materials.

During the model-making process in Case 6 *Build my city, Helsinki* and Case 7 *Build my city, Seoul*, many pupils skipped exploring the material images on the blocks, this is in contrast to Case 8 *Build my space* in which most of the pupils showed interest in the images on the blocks and asked related questions. Despite the reactions of the pupils of Cases 6 and 7, the participating teachers pointed out the *merits of the material image cards* and *building blocks*, saying these provided indirect tangible materials experience compared with *material sample kits*. Thus, it was important to consider that children primarily recognised objects, rather than materials on the images. For educational purposes, the teachers additionally suggested writing the names of the material on the cards with material images because children often asked for the name of materials with which they were completely unfamiliar. However, in order to provide children with more opportunities to independently ponder the types of available materials, the names were removed from the material image cards. Moreover, I presented the names of materials on the building blocks in order to emphasise their educational purpose, but the pupils paid them scant attention.

The material sample kits (7) were implemented in Case 7 *Build my city, Seoul* and Case 8 *Build my space*. It aimed at providing the pupils with experiences of the materials using their tactile senses. The items in the sample kits were provided by the researcher in Case 7 *Build my City, Seoul*; however, the items could be replaced or reselected according to the topics of activities with children. These were collected from the researcher's environment. Initially, the objects were found and collected by children from their daily surroundings. Based on the children's collections, the researcher replaced or added some items. According to the teachers' comments, the sample kits were selected as the most useful material study kits to enhance tactile learning for the pupils. In the sessions with the sample kits, it was difficult to share

ideas of materials experience between the participants due to a time limitation. Hence, more time should be allocated for sharing the experience in further studies.

In Case 8 *Build my space*, each pupil was preliminarily provided with the same amount of building blocks (20 small blocks and 20 big blocks) with which to build their furniture. They could use more blocks if they wished. Initially, although I explained the structure of the blocks, most pupils intuitively recognised the method of application and use. Overall, the pupils did not appear to have any difficulties using the blocks; however, some pupils asked for help attaching those blocks without groves. It might be that the grooves blocks lacked sufficient grooves to construct and show the children's original ideas. Therefore, this should be considered in further development. Afterwards, it was rather interesting that a few pupils spontaneously asked me to interpret their creations rather than me initiating the discussion.

A few participants commented that the material building blocks were one of the most exciting and fun material study toolkits. Concerning the building blocks, most children could confidently construct models in a short period. These supported the children in rapidly and efficiently developing their ideas. In contrast, the teachers selected the material sample kits as the most useful material study toolkit for children. The children directly experienced different materials with their hands. The purpose of the sample kit was to provide opportunities for a tangible material experience. Most children participated with great enthusiasm. Unfortunately, we lacked sufficient time in the workshops, thus limiting opportunities for the author and children to share material experiences. Allocating more time would be needed in further studies to encourage children to experience materials in various ways and to enable them to share their experience.

Overall, the young participants showed great enthusiasm for the practices and were satisfied with the material study. From Case 4 *Organic architecture*, many participants commented positively on the contrast of the material study from their ordinary lesson, and the usefulness of studying the materials before starting design inquiries.

*"I have been in the ARKKI class for many years, but we usually got the projects and immediately started to build. This material study was very useful for experiencing materials before starting a project."*
*(12-year-old boy from the first case)*
(ABL Memo 4, 2012)

*"The material matrices were interesting. It was neither too difficult nor too easy."*
*(13-year-old boy from the first case)*
(ABL Memo 4, 2012)

*"It was nice to use different kinds of fabrics"*
*(11-year-old girl from the second case)*
(ABL Memo 6, 2013)

*"I liked the project because you could do it yourself and no one said what you had to do."*
*(11-year-old girl from the second case)*
(ABL Memo 6, 2013)

## 4.2 Design activities for pedagogical approach

In this practice, the second material implementation sessions consisted of designerly and architectural workshops, which were intended to be similar in structures, including diverse activities, after the first material exploration sessions. The structure and process of the workshop were inspired by the project, *One World, Two Cities: Black City and White City*, by Lozanovska and Xu's (2013) pedagogical model. This project was designed for a long-term period, for a total of fourteen hours for four weeks. Based on that, I initially designed Case 4 *Organic Architecture* as a pilot case with different age groups of children in ARKKI. Adjusting for linguistic comprehension, I named this case *Animal houses* for the younger participants in this case (**Table 11**). After the pilot case with different aged groups of children, I focused on designing workshops with diverse activities appropriate for the primary school curriculum (**Tables 12** and **13**). In line with elaboration

of the *material study approaches and toolkits*, I adapted these workshop structures and contexts for ordinary primary school settings, in particular, the length of working periods, as well as the procedures and approaches of idea development in the later four cases.

Table 11. The structures and summaries of Lozanovska and Xu's (2013) pedagogical practice and two pilot studies adopting their pedagogical practice.

| PROJECT NAME | One World, Two Cities: Black City and White City by Lozanovska and Xu's (2013) | | CASE 4 *Organic architecture* | | |
|---|---|---|---|---|---|
| Location | Wales Street Primary School | | ARKKI | ARKKI | |
| Participants | 180 students (90 primary school children 3–4 graders +90 architecture university students), 30 teams, 6 in each team | | 9 students (7–9 years)<br>9 students (10–11 years) | 11 students (13–18 years) | |
| Duration | 14 hours (4 weeks) | | 6 hours (3 weeks) | 9 hours (4 weeks) | |
| Work type | Collaborative work (Children and university architecture students working together a pedagogical model) | | Individual work | Individual work | |
| Media (Activities) | Drawings, models, storytelling, computer to explore the design ideas.<br>Design activities: storytelling, discussion, sketching, model-making | | Drawings, models, storytelling, persona<br>Design activities: discussion, sketching, model-making, storytelling | Drawings, models, storytelling, photos<br>Design activities: discussion, sketching, model-making, storytelling | |
| Output | 1:20 scale model of the playground | | Scale models | Scale models | |
| PROCESS | | | | | |
| Preparation (Week 1: 2.5h) | • Mingling or ice breaking with physical activity<br>• Exploring team identities<br>• Building trust, identity and a sense of belonging | Preparation (Week 1:1.5h) | • Discussion on and studying architecture inspired by animals<br>• Drawing a favourite animal (homework)<br>• Drawing an animal on A3-sized paper<br>• Building 2.5D models on the A3 papers | Preparation (Week 1: 1.5h) | • Discussion on and studying animal architecture<br>• Selecting materials and inspiring animals<br>• Planning animal inspired buildings |
| Development of Design (Week 2: 2.5h / Week 3: 2.5h) | • Designing 'scribes' (the hands and filter for the design) | Development of Design (Week 2: 1.5h / Week 3: 1.5h) | • Planning an animal-shaped house or a house for animal<br>• Building models with child-selected materials | Development of Design (Week 2: 1.5h / Week 3: 1.5h / Week 4: 1.5h) | • Planning animal-inspired buildings<br>• Building models with child-selected materials<br>• Drawing |
| Installation, Evaluation and Exhibition (Week 4: 6.5h) | • Installation<br>• Evaluation by other stakeholders: panel of architects, parents and visitors | Story creation (Week 4:1.5h) | • Creating a story about an animal<br>• Drawing details of animals houses<br>• Creating profile of animals and its stories | Installation, Evaluation and Exhibition (Week 5. 1.5h / Week 6. 1.5h) | • Photographing<br>• Presentation<br>• Feedback |

Table 12. The different activities and tasks during the implementation sessions of *Dream park* and *Build by city*, Helsinki.

| CASE 5 *Dream park* | | CASE 6 *Build my city, Helsinki* | |
|---|---|---|---|
| Helsinki, Finland (2013)<br>25 participants (5th grader)<br>150 min<br>Collaborative activities in a team | | Helsinki, Finland (2013)<br>25 participants (5th grader)<br>240 min<br>Individual activities | |
| ACTIVITY | TASKS | ACTIVITY | TASKS |
| 1. Discussion & grouping (15 min) | • Discussion on children's experiences of parks<br><br>1. Have you ever visited a park?<br>2. What type of park have you been to?<br>3. What kinds of park are there?<br>4. What did you do in the parks?<br><br>• Sorting out materials<br>• Arranging new groups | 1. Discussion (15 min) | • Discussion on my city<br><br>1. Where do you live? What type of house do you live in?<br>2. What do your surroundings look like? What is there?<br>3. Are there any special buildings or places which you like in Seoul? Why?<br>4. Have you thought to change something about your house or other buildings? How would you like to change them? |
| 2. Planning: Discussion & Brainstorming (40 min) | • Discussion on designing new parks with team members<br>• Writing down ideas on 'Idea bubbles' sheets<br>• Selecting ideas<br>• Presenting ideas to the designer or teacher | 2. Planning & Building (60 min) | • Examining material images on the building blocks<br>• Planning new buildings<br>• Building a new building<br>• Making human-scaled models<br>• Investigating different perspectives of buildings |
| 3. Building (35 min) | • 3 to 4 different materials provided by the designer<br>• Selecting 3 to 4 different materials | 3. Drawings in details (30 min) | • Deciding on one view of the building<br>• Drawing the view<br>• Colouring and adding details<br>• Title, functions, size, materials and environment |
| 4. Building (30 min) | • Planning the space<br>• Constructing main buildings<br>• Decorating | 4. Display & Presentation (75 min) | • (Answering questionnaires<br>• Writing a story 'One day in the house') |
| 5. Presentation (30 min) | • Presenting the models (name, location, environment, functions, used materials | 5. Writing (15 min) | |

Table 13. The different activities and tasks during the implementation sessions of Build my city, Seoul and Build my space.

| CASE 7 *Build my city, Seoul* | | CASE 8 *Build my space* | |
|---|---|---|---|
| Seoul, South Korea (2014)<br>26 participants (5th grader)<br>90 min<br>Individual activities (partially team work) | | Cheongju, South Korea (2014)<br>25 participant (2nd grader)<br>80 min<br>Individual activities | |
| ACTIVITY | TASKS | ACTIVITY | TASKS |
| 1.<br>Discussion<br>(30 min) | • Discussion on my city<br><br>1. Where do you live? What type of house do you live in?<br>2. What does your surroundings look like? What is there?<br>3. Are there any special buildings or places which you like in Seoul? Why?<br>4. Have you thought to change something about your house or other buildings? How would you like to change them? | 1.<br>Discussion<br>(10 min) | • General discussion on furniture and spaces.<br><br>1. What kind of furniture do you know?<br>2. What kind of furniture do you think should be in a classroom?<br>3. What kind of furniture would suit your home? |
| 2.<br>Planning &<br>Building<br>(20 min) | • Examining material images on the building blocks<br>• Planning new buildings<br>• Building new building<br>• Making human scaled models<br>• Investigate different perspectives of buildings | 2.<br>Planning &<br>Building<br>(30 min) | • Examining material images on the building blocks<br>• Planning furniture<br>• Building furniture<br>• Photographing models |
| 3.<br>Drawings in details<br>(20 min) | • Deciding one view of the building<br>• Drawing the view<br>• Colouring and adding details<br>• Title, functions, size, materials and environment | 3.<br>Drawing furniture in space<br>(20 min) | • Planning space for the designed furniture<br>• Drawing the furniture and space<br>• Colouring and adding details |
| 4.<br>Display &<br>Presentation<br>(25 min) | • Deciding area to build<br>• Displaying the building on the map<br>• Presenting drawings and models | 4.<br>Presentation<br>(20 min) | • Presenting drawings |
| (5. Writing) | • (Answering questionnaires)<br>• (Writing a story 'One day in the house') | (5. Writing) | • (Writing about children's design models on their drawings-title, materials, feedback of workshop, reason to design) |

Mainly five different design activities were undertaken: Questioning, Planning & Building, Drawings, Display & Presentation, and Writing. Depending on the design inquiries and time frame, the activities were adjusted in the task details and undertaking period. Furthermore, the tasks needed to be changed based on the participants' comprehension of the design inquiries and task requirements (**Image 32–37**).

Image 32-37. The various activities during Case 6. Build my city, Helsinki (Lee, 2016).

## Questioning

To establish an open atmosphere and enable creative ideation, I developed familiar questions for the pupils to discuss associated with the design inquiries in different cases. There were also some follow-up questions. Furthermore, there was a discussion on building trust, identity and relationship between the pupils and adult facilitators (Lozanovska & Xu, 2013). As a facilitator, I needed to consider that the pupils might be uncomfortable expressing their thoughts to unfamiliar adults. It would not be challenging to undertake these activities with the pupils if the facilitator had already worked with the groups. In general, the building of trust and relationships between the adult facilitator and pupils should be considered as a fundamental and vital step in this type of collaborative work.

In Case 6, to begin with ideation, I initiated the case by asking general questions about the pupils' experiences in parks:

- Have you visited parks?
- What type of park have you been to?
- What kinds of parks are there?
- What did you do in the parks?

The pupils presented their collective experiences about parks, such as skate parks, amusement parks, and natural parks. When I asked general questions about their experience in parks, they displayed difficulties in presenting their thoughts at the beginning of the discussion. Hence, I elaborated on the questions and asked for more details: different functions, facilities, users and environments of parks. Consequently, this revealed that the details of questions aimed at such pupils should be carefully considered with an avoidance of abstract notions. These details could provide feasible guidance to explain ideas, but these might also block constant progress. Further, as the key principles, the entire discussion activity generated positive moods, and encouraged children to share their experiences and ideas with the adults.

## Planning & Building

Ideation with words or through sketching was often applied to the planning stage in the design process. For collective ideation, the pupils were requested to have a group discussion activity by implementing the Idea *bubble* sheets, during which the pupil could list new ideas as textual and visual descriptions in Case 4 *Organic architecture*. Otherwise, the pupils were provided with materials as physical substances and material toolkits immediately after a discussion activity to initiate new designs in Case 6 *Build my city, Helsinki*, Case 7 *Build my city, Seoul*, and Case 8 *Build my space*. As proven by the latter three cases, the tangible materials aided in the development and encouragement of creative ideas in a relatively short period (**Image 38**).


Image 38. The final models of Dream park project.

I suggested the pupils look around the model they had built from different perspectives; I also allowed them to photograph the models with their mobile phones or cameras if they so wished. However, most of the pupils were not allowed to use mobile phones during regular lessons in the classroom. Hence, I skipped photographing the models and moved to the next steps.

## Drawings in details

After all of the pupils completed the construction of their new buildings, they received the task of drawing their newly designed buildings

according to specific details, including providing a title, describing functions, size, materials and environment in Case 5 Build my city, Helsinki. In the first glance of the model, the pupils were allowed to draw the view with any drawing materials with which they were most comfortable (e.g. pencils, crayons or paints) (**Image 39**). The pupils asked a few questions related to the provided instruction to present their buildings. Then, they needed more details about the size and materials as they were confused when describing these factors between the real structures and the models made of blocks. In addition, a few pupils needed to provide further explanations or examples of the functions and environment.


Image 39. The drawing of the Tower of Pisa. (Lee, 2016).

## Display & Presentation

I displayed a map of Helsinki and Seoul with the dimensions of four metres by three metres on the floor in the classroom in Case 6 Build my city, Helsinki and Case 7 Build my city, Seoul. Most of the pupils lived in Helsinki and Seoul; therefore, they were familiar with the cities. Without being asked, they enthusiastically sought their habitat on the map. To move forward to the next stage, I needed to ask the pupils to return to their places and listen carefully to the next instructions. After explaining the new tasks, the pupils brought the models to the map.  Some spent some time deciding on the placement of their

models on the map, but most of them placed the models in the area in which they currently lived. The pupils also presented their work with detailed drawings and models on the map (**Image 40**).

Image 40. Displaying models on the map of Seoul.

## Writing

I originally included a writing activity in which pupils woulkd answer questionnaires or freely describe their created outputs during several of the workshops. However, the writing activities were added, removed or adapted depending on the school's schedules. In Case 6 *Build my city, Helsinki*, the pupils wrote about their habitat and creation with the building blocks in the questionnaires (**Questionnaire1**).

The completed questionnaires included rich and extensive information about their ideas and thoughts on their design outcomes. I encountered interesting aspects during the analysis. Additionally, the schoolteacher suggested having one more writing activity to create a fictional story, *One day in the house* at the end of the session (**Writing 1**). In Case 7 *Build my city, Seoul*, the pupils ended the session by displaying and presenting the outcomes without a writing activity. After the session, the schoolteacher separately conducted the writing activities on the next day of her regular class.

**About your living places**

1. Where do you live?
2. What do your surroundings look like? What is there?
3. Are there any special buildings or places which you like in Helsinki? Why?
4. Have you thought of changing something about your house or other buildings? How would you like to change them?

**About your new building design**

1. How many blocks did you use to build your building?
   Small blocks -
   Big blocks -
2. Why did you choose those particular material blocks to make your building?
3. What kinds of functions do your building have?
4. How big is your building? (size)
5. What kinds of material is your building made of?
6. Where would you like to place your new building? Describe the surroundings of your building.

Questionnaire 1. The questionnaires about living place and creation with building blocks in Case 6 *Build my city, Helsinki* (Lee, 2016).

**One day in my building**

Once upon a time, a man was walking past my building. He was called Jack. It was a dark Halloween night. Jack heard load screaming from one of the housed in my building and after whilst it stopped, but a knife was thrown from the window. When he picked it up from the ground, he realised that it was full of blood. Jack went inside the building and saw spider webs all around the hallway and in the lift. He found the house that the screaming came from and knocked on the door. The door opened slowly, and it was making creepy noises. Suddenly, a vampire appeared with a glass of blood in his hand. Jack peaked behind the vampire and saw blood on the carpet. Jack screamed and ran away to the police station. The police went to the house and started investigating. It turned out that it was all a misunderstanding. What happened is that the person who lives in the house was cutting tomatoes to make tomato juice. Whilst a horror movie was on. He watched the movie with the knife and the glass of tomato juice in his hand. He got scared and screamed. Whilst he yelled the knife flew from his hand out the window. He also dropped a bit of the juice on the carpet. The person was wearing his vampire costume, and the spider webs were in the hallway because the cleaner was sick for two weeks. After Jack heard what happened, he got relieved and went home.

Writing 1. An example of one girl's story, One day in the house (Lee, 2016).

During the writing activities, the pupils wrote the tasks in English (Case 6 *Build my city, Helsinki*) and Korean (Case 7 *Build my city, Seoul* & Case 8 *Build my space*). Although the class in Case 5 *Dream park* consisted of bilingual children, the choice of using the mother tongue and second language impacted the children's writing in different ways. However, this practice left aside children's language studies for potential later research. Instead, this research concentrated on providing the pupils with diverse activities within the design inquiries. In particular, the writing activity in Case 6 *Build my city, Helsinki*, One day in the house, became a multidisciplinary learning and teaching approach, covering areas, such as art, literature and English. As such, the adult facilitators guided the pupils when they required grammatical support or further explanations about the questionnaires.

As mentioned earlier, Case 5 *Dream park* was planned to be conducted over a long-term period; for later cases, the structure and content were adjusted for standard primary school settings with more condensed schedules. Nonetheless, each programme followed a similar structure. This structure is described and discussed in more detail in Chapter 6.

## Integrated curriculum

During the workshops, the pupils created various outputs in the form of modelling, drawing and writings. All of these activities were under the same theme and amended details. The model-making activity was simple and appropriate for the pupils and was quickly linked to other related activities. Some pupils said that it was one of the more enjoyable activities during the session (n=4). On the other hand, drawing and writing supported the goal of investigating the pupils' ideas. The drawing demonstrated more detailed plans: the pupils added windows, doors and other decorations. Furthermore, the pupils who were seated together and worked closely together arrived at similar outcomes; for example, two boys who were sitting next to one another from the first group, made the Tower of Pisa. A few pupils showed interest in a large-sized map and tried to find their places on the map. In addition, the pupils worked effectively according to the schedule; therefore, the teacher suggested having one more writing assessment,

*One day in the building*. It was a fictional writing assignment and provided an opportunity for the pupils to practice their English. The combination of the different activities achieved a multidisciplinary teaching and learning process, as well as approaches in diverse areas. This approach could also be applied to other contexts.

The teachers from Case 6 *Build my city, Helsinki* commented that the project included suitable learning challenges with the exciting hands-on activities pleasing the pupils and encouraging voluntary participation in class. They also mentioned that the workshop had multidisciplinary teaching and learning approaches in disciplines, such as arts, design, architecture, mathematics, geography and linguistics. They were pleased to have this type of teaching-learning process and approach in their class. They incorporated this project into their curriculum, thus enabling teachers to teach children literacy (through material games), mathematics (through size), art (through drawing), crafting (through modelling), geography (through displaying on the map), and communication (through discussion).

In Case 8 *Build my space*, the teacher shared that the toolkits provided during the material exploration and implementation might be very similar to the integrated education procedure. The topic, furniture and space, contents, and materials were familiar elements related to our everyday life. Hence, the pupils were quickly able to immerse themselves in the project. In particular, these also were associated with the subject, *Seol-gi-ro-un-sang-hwal*. She also acknowledged the importance of the material categorisation task, even though this age group of children (the second grader) were cognitively confident with this type of task because they could learn the skill of categorising through designerly activities. Furthermore, during the workshop activities, the pupils had opportunities to learn new words and concepts related to materials. By providing one more writing activity combined with a drawing activity, this project had also impacted their language learning. Consequently, these approaches and toolkits provided in the project could be integrated into the primary curriculum in Korean schools.

Occasionally, we encountered a need to modify the design process and tasks due to limited time. Initially, this material study and design implementation were designed for six hours based on the structure of Case 6 *Build my city, Helsinki*. However, the workshops were conducted

for less than two hours, and I thus eliminated some activities. Moreover, most tasks were targeted at fifth graders; therefore, I needed to adapt some tasks for the younger participants. It was essential to co-plan or confirm plans with the classroom teachers before beginning the projects with the children.

Based on the feedback from the classroom teacher in Case 8 *Build my space*, this case had very similar approaches to the integrated curriculum in the Korean primary school. In South Korea, the current education has focused on an integrated curriculum among different subjects, and this already starts from the first grade in school. For instance, several subjects are integrated into one subject, and classroom teachers are allowed to create the timetable and curriculum according to her discretion from the second to third grades. From the fourth grade, the integrated subject is divided separately into art, music and physical education.

## Design-centred learning (designerly knowing and skills)

This material study activities supported children's designerly knowing and skills through this pedagogical practice. Materials are highly influential in decisions made by designers whose work is intended to be physically realised. Therefore, children can learn the decision-making process through designerly-ways of knowing during this materials' study practice (Pedgley & Sener, 2017). Based on the participants' verbal and written comments, the pupils learned four significant features during the practice:

1. I experienced different materials and became acquainted with new materials
2. I became aware of my surroundings (park, building, city, environment)
3. I learned new skills (designerly skills) and became acquainted with the design process from a design expert
4. I could communicate and collaborate with peers in a team (respect the team members) Interestingly, this practice also changed some pupils' negative attitude toward specific lessons.

One girl from Case 8 *Build my space* stated that she did not like art and craft-making; nevertheless, she enjoyed the workshop. When she was considering her future job, she stated she would want to be a furniture designer. I was impressed on reading one of her comments: she built the model to make her dreams come true. This type of teaching and learning approach could encourage a more positive attitude and increase motivation for the pupils in the school lessons, in particular for the subjects to which they might have an aversion.

## 4.3 Adapting for different ages

In Case 4 *Organic architecture*, different age groups of pupils selected diverse materials during the material study. According to their ages, I organised and adjusted distinctive material study approaches and toolkits. For the younger pupils (7–9 years), the material matrices was removed and replaced by the material frottages in Case 4 *Organic architecture,* and the material collages in the box in Case 5 *Dream park.* As previously mentioned, the focus of this research was not on comparing perspectives; instead, any amendments were more focused on being age-appropriate for the participants and appropriate to the research settings. These provided flexibility to implement different contexts and circumstances in this research.

The pupils from Case 6 *Build my city, Helsinki*, Case 7 *Build my city, Seoul*, and Case 8 *Build my space* selected 15 types, 12 types and 11 types of material, respectively. The youngest group chose more diverse materials compared with the other older groups. The results of the second and third groups showed similar selections, except for cardboard and fabric. All the pupils collected materials and created 296, 65 and 56 material collages, respectively. The pupils from each group gathered an average of 30, nine and six material samples. Consequently, the youngest group selected more considerable amount of materials compared with the other groups; in contrast, the oldest group chose smaller amounts of materials per pupil.

In Case 6 *Build my city, Helsinki*, the pupils selected 11 different materials during the design implementation session. The amount

selection differed from each pupil (min. 2 to max. 6). Wood, cardboard, fabric, paper and natural leaves were mostly selected; yet, metal, concrete, tiles, wood, glass and cardboard were also popular in the material study. However, the selection of materials decreased whilst building the models, eight out of ten pupils chose less material in this period compared with the first selections.

In Case 7 *Build my city, Seoul*, nine pupils selected ten different materials. Wood, natural leaves, paper, plastic sheet and fabric were mostly selected. In comparison with the selection from the materials exploration, wood and fabric were the same choices. However, wood, fabric, plastic, and metal were the most collected materials during the material study. Similar to the first group, the selection of materials decreased whilst building models. Four out of seven pupils chose less material in this session. Interestingly, the pupils showed similar selections between the materials exploration and implementation session. In the second group, pupils were requested to list the materials they planned to use for their buildings. They selected more materials for modelling compared to their initial plans.

In Case 8 *Build my space*, 11 pupils used only six different materials. In comparison with the material selection during the exploration, the pupils selected less diverse materials for modelling: cardboard, plastic sheets and wood were mostly used. The pupils selected cardboard and wood in both the material exploration and implementation. Again, seven out of nine pupils selected less material during the modelling session. They intended to use somewhat similar material selections between the materials exploration and implementation sessions. In this group, the materials selected for modelling did not remain the same at the end of the workshops. Half of the group of pupils, five out of eight, changed their plans.

With the *material matrices*, I only applied them to the second and third groups. To the first youngest group, the concept of matrices was incomprehensible; therefore, I chose the material frottages instead to explore the different surfaces and textures of materials. In the second group, seven pupils participated in the material matrices creation. They practised comparing the different tactile experience of materials. Different types of cardboards were grouped based on different thickness, density, softness and hardness (**Image 41**).

In Case 4 *Organic architecture*, the pupils were also divided into two small groups to work on creating the *material matrices* (Group 1: 5 pupils, and Group 2: 4 pupils). In this group, there were insufficient *material collages*; therefore, I added more collages from the second group. At the end, they had duplicated material collages with the same materials. It would have been easier to have one collage among the same materials to create the material matrices. The pupils commented that this practice was different from the usual lesson in ARKKI, but that it was useful to focus on studying the materials before initiating the building tasks.

Image 41. The Material Matrix from the second group in ARKKI.

As a result, the three different groups separately worked based on the pupils' ages as well as their designerly and architectural experiences. As earlier stated, the scope of this research does not include a numerical comparison resulting in the approaches and toolkits being dissimilar between the first group and the other two groups. Hence, the results could not easily be compared; however, significant patterns were indicated by different age groups. First, the younger pupils from the first group showed greater interest in the diverse array of materials available to them as shown in their materials selection, compared with the older pupils from the second and the third groups who selected

less and with more forethought. Secondly, the pupils in the first group indicated significant differences when selecting materials from the exploration to implementation. However, the older pupils from the second and third group chose similar materials from the exploration to the implementation. Thirdly, the pupils from each group were distinctively aware of the materials due to the activity of displaying the material matrices. Many categories were positioned in slightly different positions among the groups. Fourthly, the pupils who participated in the exploration session interestingly selected a greater variety of materials compared with the pupils without the material exploration. As proven by the material selections between the material exploration and the material implementation sessions, the older pupils intellectually linked their material selections from the exploration to the implementation. However, this assumption needs to be proven in further studies since most of the older groups of pupils participating in ARKKI possessed extensive experiences on handling physical substance as well as these types of designerly and architectural projects. Overall, the pupils showed enthusiasm for the material study practices and were satisfied with this approach and learning process.

*"I have been in the ARKKI class for many years, but we usually got a project and immediately started to build. This material study was a useful way to experience materials before starting a project." (12-year-old boy)*
(ABL Memo 5, 2012)

*"The material matrix was interesting. It was neither too difficult nor too easy." (13-year-old boy)*
(ABL Memo 5, 2012)

After the material exploration session, we continued to the design inquiry, Case 4 *Organic architecture*. To facilitate the younger pupils understanding and engagement, we also entitled this project 'Animal houses'. This did not merely mean houses for animals, but it also included housing inspired by animal inhabitants. In spite of my expectations of seeing a variety of different functioning outcomes, only one

pupil built a house inspired by animal inhabitants, and the others created houses for animals.

In the third group, the pupils designed different building functions. 60 % of the architecture was located in the city and the others in a natural environment. The architecture in the city was types of schools, churches, museums and libraries. On the other hand, the architecture in the natural environment was types of houses, saunas and summer cottages.

The selection of materials from exploration to implementation decreased (seven out of nine pupils). However, the pupils selected similar material types between the exploration and implementation. I advised the pupils to be aware of material distinctiveness between their design models and actual construction outcomes. Thus, the pupil could learn the appropriateness of materials in actual construction procedures.

## 4.4 Playful, flexible and instructive session

### Playful and familiar environment as well as new arrangement

To enhance an active working atmosphere, I initiated a discussion on materials related to their regular class in school. After the participants were accustomed to the context of the project, the designer introduced the structure of the workshops, including the materials games at the beginning of the session. The pupils were extremely excited to participate in the session since they would play the material games rather than their regular studies. Using the term 'games' in the lessons forged a positive atmosphere in the educational setting.

In Case 5 *Dream park*, all the activities were organised as collaborative works; in addition, the material exploration and implantation were conducted on separate days. I had requested the schoolteacher arrange working groups in advance; therefore, on the first day, the pupils were organised into six different groups: two boy groups, two girl groups, two mixed groups. On the second day, I suggested a new way of forming the groups based on the results of material selection with the image cards. The 25 pupils were formed into six new groups for further activities (**Table 14**).

All six groups consisted of three to five members; however, one girl, who was supposed to be in the last group, was absent from the second session. The six groups were labelled according to alphabetical letters with the names of their main selected materials. In addition, I distinguished all the materials collected by the pupils as the same material categories of material cards, such as fabric, food, natural source, paper, and plastic. Some materials were varied; however, collecting natural sources was limited due to the winter season.

Table 14. New group arrangement & material condition.

| GROUP NAME | MEMBERS | MAIN SOURCE | PROVIDED MATERIALS |
|---|---|---|---|
| Group A | 3 boys, 2 girls | Natural source | Cotton, veneer, wooden sticks, pine corn |
| Group B | 2 boys, 3 girls | Food | Pasta, bean, nuts & jelly, rice |
| Group C | 4 girls | Mixed | Plastic wrapping paper, rope, cardboard |
| Group D | 4 boys | Metal | Metal wire, paper, paper straw, cardboard |
| Group E | 3 boys | Paper | Cardboard, toilet paper, fabric |
| Group F | 2 boys, 1 girls | Mixed | Fabric, rope, recycled paper box, cardboard |

## Idea generation and decision-making by children

The newly grouped pupils discussed designing new parks with their team members. The pupils simultaneously generated various ideas on Idea *bubbles* (**Image 42**), which were the pieces of sheet designed for generating new ideas both in words and illustrations, as well as displaying relations among the ideas.


Image 42. The Idea bubbles sheet.

Among many ideas, the pupils in each team selected a few ideas and included them in the design outcome. As Table 14 shows, the chosen ideas in the team had no link to the number of ideas suggested by each pupil. It was interesting to investigate the pupils' discussion and decision-making in the groups. After filling in the Idea bubbles, the pupils in different groups had to present their plans to the teacher or me informally. Interestingly, the pupils simultaneously discussed and wrote down their ideas; therefore, the pupils in the groups consequently represented similar ideas. However, each group presented distinctive plans. Afterwards, each group was provided with three or four main materials in a paper box, material palettes, and they could choose two or three other extra materials as they wished. With various physical substances, using their ideas, the pupils built their dream park following their plans for approximately an hour. Since the main materials had already been provided for each group, I assumed that the provided materials might have inspired the pupils' ideation (**Table 15**).

Table 15. The ideas on Idea bubbles and idea selection by the pupils.

| GROUP NAME | MEMBERS | INDIVIDUAL IDEAS | SELECTED IDEAS | GROUP IDEAS |
|---|---|---|---|---|
| GROUP A | Female | 6 | 3 | Plan: Everyone's park (skate park, playground, café, mini-golf, trampolines)<br><br>Model: Playground (swings, slide, sand box, trampoline, flag, bridge, river), Skate park (skateboard hill, pull-up bar) |
| | Female | 10 | 3 | |
| | Male | 11 | 4 | |
| | Male | 12 | 6 | |
| | Male | 13 | 1 | |
| GROUP B | Female | 6 | 3 | Plan: Amusement park (ice-cream, trees and bushes, hamburgers, grass, candy trees, candy house, Ferris wheel)<br><br>Model: Amusement park (candy house, food bar, Ferris wheel, fountain, shelter, pond, cotton candy, grass, food tree) |
| | Female | 11 | 5 | |
| | Female | 15 | 6 | |
| | Male | 4 | 3 | |
| | Male | 4 | 3 | |
| GROUP C | Female | 6 | 1 | Plan: Two area with different time (modern area, historic area, gate, wheel, building)<br><br>Model: Duals (castle, Ferris wheel, river, bridge, grass, gate, water fall) |
| | Female | 8 | 2 | |
| | Female | 13 | 2 | |
| | Female | 10 | 3 | |
| GROUP D | Male | 13 | 2 | Plan: Sports park (basketball court, paint ball, rugby court, skateboard park)<br><br>Model: Sports park (basketball court, paint ball, rugby court, skateboard park) |
| | Male | 16 | 3 | |
| | Male | 13 | 4 | |
| | Male | 14 | 1 | |
| GROUP E | Male | 15 | 4 | Plan: Castle (castle, fountain, shark)<br><br>Model: Shark pool (shark pool, castle, diving board, stairs, tent) |
| | Male | 9 | 3 | |
| | Male | 11 | 1 | |
| GROUP F | Male | 10 | 2 | Plan: Natural park (trees, grass)<br><br>Model: Water park (large cliff, restaurant, grass, waterfall, tree) |
| | Male | 14 | 3 | |
| | Female | 9 | 2 | |
| | Female | | | |

Each pupil created diverse ideas as you can see from **Table 15** above; afterwards, the pupils discussed choosing the main theme for designing their dream park with team members in the same groups.

Ideas from the pupils were already somewhat similar as they simultaneously wrote down and discussed their ideas. Nevertheless, the pupils presented and shared their thoughts on the Idea bubbles shown previously. During the group discussion and selection of the theme and ideas, there were several impressive results. A few pupils' ideas were principally accepted after comparison to the others. The other pupils' ideas were seldom accepted despite them suggesting some ideas; for instance, although one boy from Group A presented 13 ideas, only one of his ideas was accepted for the group work. According to the teacher's comments, several pupils behaved somewhat imperiously, and some others only occasionally followed their peers during their group work. As a general stereotype, girls clearly expressed their opinions in groups compared to the boys, but the results in this research were contrastive. The results of the idea selection from three mixed groups represented almost equal power between girls and boys in the groups; although, in Group A, the boys' ideas were more dominant than the girls'.

In addition, the teacher mentioned that a few pupils behaved differently during this group work, working more harmoniously in their groups in contrast to their performance in group work during ordinary school lessons. These results should raise significant discussion in further study on children's group work in different learning environments, including external facilitators (instructors) and group arrangements for further studies.

## Flexible instruction and diverse representation

In Case 5 *Dream park*, the pupils were enthusiastic about choosing their materials; for instance, one group used eleven types of materials and a couple of groups did not use the provided materials at all. It was difficult to determine the amount and types of materials for the design inquiries; therefore, I let pupils bring extra materials from the material storage as the occasion demanded. To conclude, instructions should be precise for the specific resaerch goals; on the other hand, there is a need to be flexible to provide the pupils with freedom. This freedom might encourage pupils' enthusiasm and motivation to be active in their work.

*"I think this was nice. You are free to choose. No one tells you what you should do." (11-year-old boy)*
(ABL Memo 5, 2013)

*"I think the groups were ok, and it was nice to do something other than normal school." (11-year-old girl)* (ABL Memo 5, 2013)

Compared with the previous cases in ARKKI, these cases newly attempted to introduce the material image cards. The pupils in ARKKI had already experienced designerly and architectural projects for several years; therefore, they were familiar with different material and their physical substance. Further, the working studios were fully equipped with various materials and appropriate tools for cutting and handling materials. Hence, I immediately proceeded to search for materials and produce the material collages with the pupils. Nonetheless, some of the pupils in the ordinary primary schools had distinctive material experiences, and classrooms had limited supplies with which to experiment with different materials. For these reasons, I needed to provide new toolkits, the Material image cards, to trigger pupils' thoughts and understanding about materials.

The material image cards comprised fifty different material images, and they were divided into material cards Set A and B, which included six different material types, such as fabric, food, natural source, metal, paper, plastic, and wood. Wood was included as a natural source in the data analysis. In Case 5 *Dream park* and Case 7 *Build my city, Seoul*, Finnish and Korean pupils demonstrated these material image cards. In each case, three groups were given material cards Set A, and the other three groups were given material cards Set B.

The pupils in both settings had slightly different activities with the *material image cards*. For the Finnish pupils, they were requested to form groups of six different material categories following instructions with 50 cards. Afterwards, they chose four cards which they liked and described the names, feelings, and uses of the materials. This is in contrast with the Korean pupils, who were requested to first choose nine favourite material image cards and to describe the names, feelings, and uses of the materials on the sheets of material palettes. Then, they grouped the material cards by themselves without pre-instructed

categories. These included different structures of instructions. Among the similar categorising activities, the Finnish groups received precise instructions and the Korean groups received slightly less structured instructions. Consequently, the Korean pupils categorised the cards into eight to nineteen different groups. The categories were assorted into different criteria. Nevertheless, this little freedom boosted the pupils' conviviality helping them to overcome challenges of managing the given tasks.

At the beginning of Case 8 Build my space, I initiated a general discussion to engage a lively and free atmosphere with the pupils. In this type of activity, it was important to let the children talk, although they occasionally went off-topic. Adult facilitators should consider the need to be patient and spend extra time forming their research objectives when working with children. The essential step is to engage them in the activities themselves rather than completing planned tasks. For instance, I asked them about their experiences in art and craft activities in school to discuss different types of furniture and associated materials. They commented on activities including folding papers, drawings, sketching, building models, drawing murals, hands or foot stamping. We attempted to guess the materials from the activities (stains, pastel, crayon, pencils and tapes). Afterwards, we moved on to discuss the materials for chairs and desks. The pupils answered that these were made out of wood, steel and plastic. Several pupils also commented on the required tools, such as screwdrivers, screws and hammers; but I let them talk first, then I later explained the differences between materials and tools rather than ignoring or stopping unexpected or irrelevant answers.

A few pupils raised some concern about the differences between their drawings and subsequent models. I did indeed notice a difference between these two creations in their drawings, and many pupils had imitated the example drawn by the adult facilitator on the blackboard. During the presentation, several pupils criticised those pupils who had appeared to mimic the adult's examples.

I estimated the space suitable for the furniture created by the pupils. However, a few pupils' suggestions of space were not ideal for their designed furniture; for example, one pupil represented a bed and a sleeping person in the kitchen in his drawing. Overall,

the scale of the furniture was not well matched, and the pupils often depicted objects or things, which they thought more important. Moreover, most of the pupils described front views, but several pupils mixed the front and top views in their drawings. Interestingly, one boy included measurements between the furniture and the size of the space. His drawing was reasonably similar to his models. I assumed that this pupil had more advanced experience and understanding of this type of inquiry.

## Design expert's intervention in the school curriculum

As earlier mentioned, the teachers generally used their intuition or experience for the group arrangements in the class. The teacher participating in the second group suggested that she had pre-conceptions about pupils working in groups. Based on her teaching experience, she organised similar group arrangements in most of the pupils' group work. At the beginning of the second session in Case 5 *Dream park*, she had been concerned about the new group arrangement, which I had proposed based on the material selection results from the material image cards. Nevertheless, despite her concerns, all the groups worked effectively and collaborated well. The design expert's intervention discontinued and changed the teacher's own notion about pupils' group work. The results raised interesting observations on pupils' group work in different learning environments. This would be worth studying further.

According to the interview with the teachers in Case 5 *Dream park* and Case 6 *Build my city, Helsinki*, they would like to rely on experts to participate in class in specialised subjects, since the teachers could not cover all the areas to be taught. However, it was a challenge to find experts who were able to take into consideration the pupils' level of understanding and age-related responses. For instance, once she invited a professional, a fireman, to talk about his professional experience to the pupils; however, he could not cope with the pupils' overwhelming interest. Significantly, the teacher revealed a collaborative intention to work with experts in their teaching, but the requirement of the expert needed careful consideration as regards them fulfilling both learning and teaching goals, as well as unique experience in particular to the pupils.

During Case 8 *Build my space*, I invited a furniture designer to the sessions, and I was able to collect extensive feedback from another design expert. This designer felt that she was able to encourage and engage children's thoughts and creativity throughout this project. She also reflectively considered the best way to face and communicate with people. She commented that it was fascinating to observe the pupils during their use of the toolkits, as well to help them become familiar with, think through, and bring to completion creative outcomes. She also became more aware of the distinctiveness between professional designers and ordinary people. This is a provocative insight, which might demand a more thorough discussion. By focusing on engaging people to think and providing possibilities, conducting workshops has excellent potential and creates a positive atmosphere.

## 4.5 Adaptation of activities in different cultural settings

### Overview

Geographically, this practice was undertaken in two different locations, Finland and South Korea. Although this research had no comparative purpose, some interesting distinctions were noted. At first glance, the Korean pupils were more active in the discussion. With the schoolteachers' assistance, I endeavoured to maintain some calm among the pupils during some activities or gain their attention to share instructions for further activities. I assumed there would be a difference between bilingual and mother-tongue speaking pupils. However, the pupils in both settings were actively dialoguing during their peer activities.

The fifth graders in both the Finnish and Korean schools participated in Case 5 *Dream park*, Case 6 *Build my city, Helsinki* and Case 7 *Build my city, Seoul*. Focusing on the comparison, the material exploration in Case 6 would be compared with Case 7, which combined the material exploration and design implementation during the case. Although the activities were dissimilar and the instructions were adjusted depending on the situation, nevertheless, I chose the material image cards, collages and matrices in the material exploration sessions, as well as build-

ing blocks in the material implementation sessions in both settings.

The Korean pupils relied on the adults' (researcher and teachers) instructions more than the Finnish pupils. For instance, several Korean pupils requested detailed explanations on the tasks; therefore, I provided concrete examples, such as drawing examples on the blackboard. This resulted in several pupils imitating the examples rather than creating their own design.

## Material selections

The Finnish pupils selected four of their favourite materials from fifty different *material image cards*. Two pupils merely chose three cards instead of four. However, the Korean pupils were requested to select nine favourite materials from the *material image cards*. To compare with some of the findings between these two settings, the total numbers of material selections were dissimilar; therefore, according to priority, I converted the quantities of two cases to a total of one hundred and compared the pupils' material selections. **Diagram 8** represents the pupils' material selections between the Finnish and Korean pupils. Interestingly, both groups of pupils mostly selected natural sources and food. The other material group selections were dissimilar.

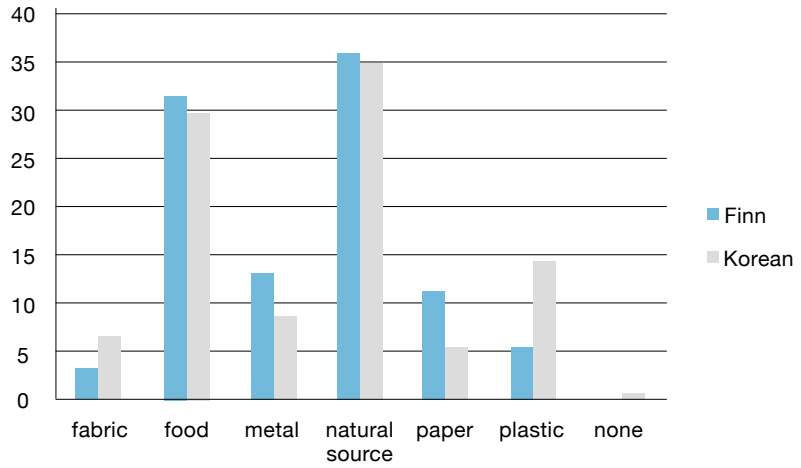



Diagram 8. The material selections from the material image cards between the Finns and Korean pupils.

## Material matrices

The material selections from the haptic material samples were challenging to compare with these two cases due to different instructions. Initially, I planned to collect materials by the pupils as pre-assessment before the exploratory sessions. With the Finnish groups, I requested the pupils gather materials from their surroundings. The teacher saved the collected materials, and I displayed them in the classroom. The pupils experienced the different materials presented in the classroom and selected four materials with which to create material collages after the material exploration exercises with the image cards. However, the collection of materials were not diverse; therefore, I provided the Korean pupils with the *material sample kits*, which comprised more varied types of materials. Although the collection of materials from the Finnish groups was limited, the pupils had opportunities to compare various haptic experiences of materials. Thus, we carefully and diligently sorted the materials in advance.

In addition, the activity to create the *material matrices* was distinctively conducted. Due to the limited time, all of the Finnish groups created one *material matrix*. In comparison, the Korean groups created separate material matrices per groups. This activity presented several interesting scenes rather than a quantitative comparison between the Finnish and Korean groups.

25 Finnish pupils produced 99 material collages; each pupil made four collages, but one pupil merely created three collages. Between the boys and girls in this group, they showed similar material selections; they mostly selected pasta, felt, and veneer as their favourite materials. Girls, on the other hand, also selected plastic-wrapping papers (**Diagram 9**).

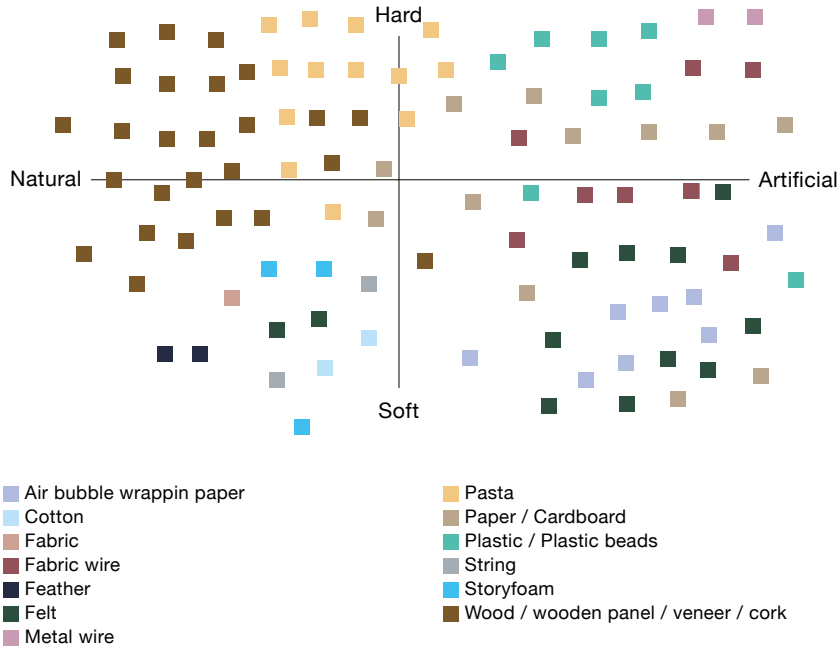



Diagram 9. The diagram of matrix from the Finn class.

On the matrix, there were four distinctive sets of adjectives to describe pupils' haptic perception of the materials included within the *material image card* sets: 1) Soft – Hard, 2) Natural – Artificial, 3) Easy to bend – Hard to bend, and 4) Easy to cut – Hard to cut. For my first attempt using the matrix, I selected two sets of words and initiated the matrix, which consisted of two transections: 1) from left to right: Natural - Artificial; and 2) from top to bottom: Hard - Soft. Once it was set up, one group of pupils immediately approached the matrix on the wall and placed their material collages in the transections. The schoolteacher and I assisted the pupils. Compared with the matrices by the Korean pupils, the Finnish pupils spread their collages out on the whole matrix (**Diagram 8**). In contrast and as earlier mentioned, the Korean pupils organised the matrices into six different groups. In addition to that, they had opportunities to select the adjectives with which to create the matrix transections rather than be provided with the words by adults (**Table 16**).

Table 16. Comparison word selections by group on the matrices.

| GROUP | LEFT - RIGHT | TOP - BOTTOM |
|---|---|---|
| GROUP 1 | Soft – Hard | East to cut – Hard to cut |
| GROUP 2 | Artificial – Natural | East to cut – Hard to cut |
| GROUP 3 | Soft – Hard | Hard to cut – East to cut |
| GROUP 4 | Easy to bend – Hard to bend | East to cut – Hard to cut |
| GROUP 5 | Hard – Soft | Easy to bend – Hard to bend |
| GROUP 6 | Easy to bend – Hard to bend | Hard – Soft |

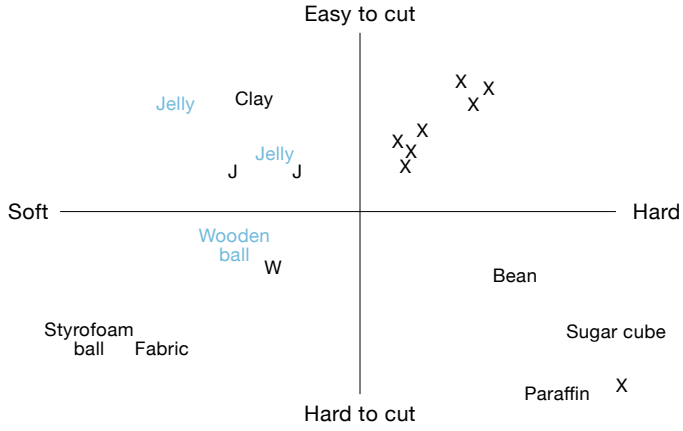
**Diagrams 10, 11, 12** and **13** represent the four material matrices from the different groups in the Korean class. Initially, six groups participated and created these material matrices; however, there were two pairs of matrices (Group 1 and 3) which were comparable among the six different material matrices in terms of the selection of the same comparison words. The matrix from Group 3 was needed to transit from the top and bottom for similar settings. The two matrices below indicate children's awareness of the materials. The same material could be located in entirely different positions in the matrix due to the comparable materials. For example, the pupils from the first group placed the wooden ball as a type of soft material compared to beans, sugar cubes, and paraffin; on the other hand, the pupils from the third group placed the same wooden balls as a type of hard material in comparison with sponges. However, the veneer should be positioned as softer than the wooden ball in the matrix of the third group.

Interestingly, the Korean pupils combined the same material collages and showed one collage to represent the materials on the matrices. The pupils also carefully distinguished the same type of materials depending on their haptic experience despite them selecting the materials from the sample kits. For instance, the pupils separately positioned the different kinds of jellies: one type was slightly softer than the other.

The sixth matrix should be rotated ninety degrees due to an equivalent comparison with the fifth matrix. The intersection on the matrices

described the degree of hardness from left to right and bendability from top to bottom. The sixth matrix showed a slightly clear display in terms of the bendability of each material. I assumed that the second comparison would challenge the pupils. They would have required adult assistance.

Group 1.




Group 3.

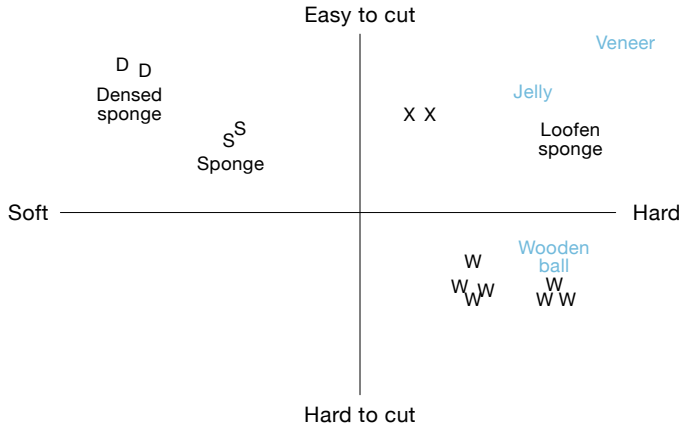
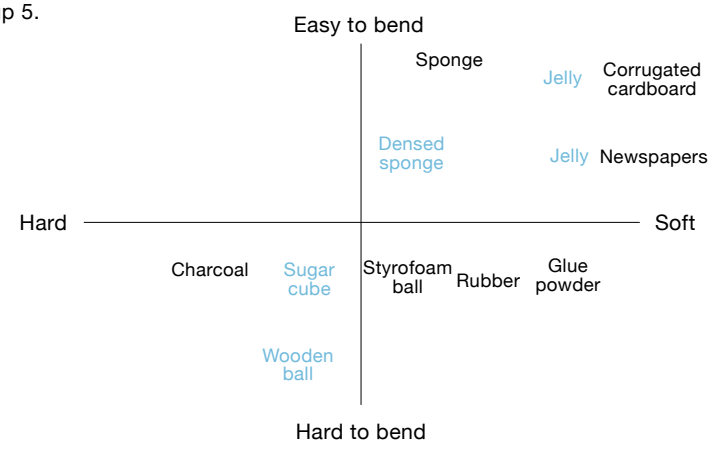



Diagram 10 & 11. The pupils showed one material on each matrix, and I marked them with the first letter of the material's names; the grey X was non-distinguishable collages; the marked red materials were differently positioned between Groups 1 & 3.

Group 5.




Group 6.

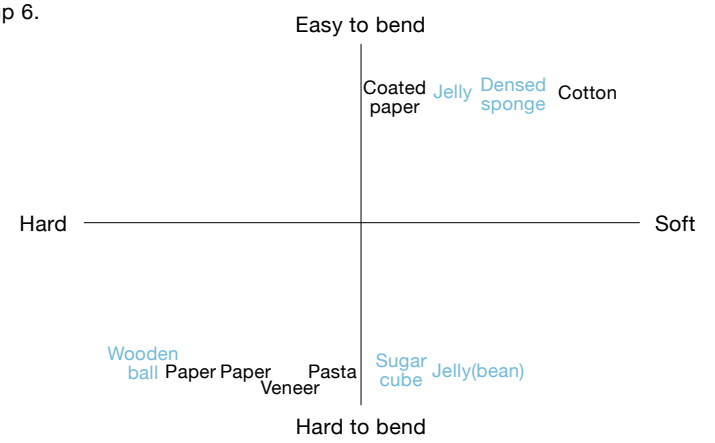



Diagram 12 & 13. The pupils showed one material on each matrix, and I marked them with the first letter of the material's names; the grey X was non-distinguishable collages; the marked red materials were differently positioned between Groups 5 & 6.

## 4.6 Key insights and progress in Chapter 4

Elaborating on Lozanovska and Xu's (2013) pedagogical model and practice, this research has formulated pedagogical practices with school-aged children through design activities in various settings; therefore, this research enhanced children's materials experience and explored values of design in their education. During these practices, the children developed their materials knowledge, values and skills through active learning activities. In particular, the materials knowledge (in the material exploration sessions) propositionally merged into real-world contexts through the children's design activities (in the material implementation sessions). Hence, the propositional knowledge as well as the empirical knowledge of materials and design were interconnected and balanced (Pedgley & Sener, 2017).

Throughout these practices, I developed the material study approaches and toolkits, and have shared my initial findings on working with different age-groups of children, balancing the working atmosphere in activities with children, focussing on integrated teaching and learning, and considering the adaptability of this approach in different cultural settings. Chapter 5 synchronises these significant findings among earlier studies and the cases in this practice identifying three issues: the material matters, structure and framework of this research.

# 5.1 Material matters

Children learn about the new world by expressing their thoughts and emotions through distinctive senses: sight, hearing, touch, smell and taste. This interactive learning proceeds during the infant stages of child development: for example, babies learn and adopt new environments through touching objects with their hands or mouth. This learning and experience through the senses has been applied to children's development and education. The Montessori approach, a well-known philosophy in child education instigated by Maria Montessori in 1906, encourages the harnessing of materials available in the surrounding environment to promote learning through hands-on-activities (Montessori, 1994, 2004).

Another aspect to consider is the optimal avenue through which to analyse children's experience of this type of learning. Children's drawings have been examined to interpret their perspectives and experiences (Piaget, 1970). Indeed, these have recently been used to capture children's views to develop computer programmes (Sheenhan, 2003). They have also been employed in the field of pedagogical research to gather data about students' experiences (MacPhail & Kinchin, 2004), and in the child-centred approach as a helpful evaluation tool (Xu, Read, Sim & McBanus, 2009). However, not all children are confident in drawing. To investigate children's general interests, I conducted observational studies during children's activities in indoor and outdoor settings in Chapter 3. As confirmed by the initial findings from the preliminary research, many of the children expressed difficulties with drawing and exhibited little confidence during the investigation. Instead, they were more comfortable and confident in handling tangible materials to embody their ideas.

I conducted observational studies on materials in children's indoor and outdoor activities, as well as applied various *material study approaches and toolkits* in the respective locations in Finland and South Korea. I initially scrutinised other scholars' perspectives on materials in designing with children focusing on defining the meanings of material in this research. I have accentuated designerly ways and skills as well as the meaning of materials as a medium to offer young people diverse opportunities in their education. This section (5.1) has been

rewritten based on my publication - *Tangible opportunity*: Material study approaches and toolkits in education for children, presented at the EKSIG 2017 DRS Special interest group on experiential knowledge conference at the Delft in the Netherlands, 19-20 June 2017.

## Interaction with and through materials

To understand children's general interests, I conducted observational studies on children's indoor and outdoor activities, which were described in Chapter 3. From this observational research, the children showed enthusiasm for materials as physical substances and interacted with them in diverse ways. During the studies, I took notes describing significant moments and scene, and these notes have marked as the memo in the Archive of Bang Jeon Lee (ABL) (**Memo 7**).

Episode 1.
One boy made three islands and connected them. He wanted to build bridges starting from the islands out to the sea. He also wanted to include the sky in part of his modelling. He explained that the sky began at the end of the sea and that there were clouds in the border. It seemed that he had a notion of a horizon and it made me very impressed (Notes on Thursday 15. 03. 2012).

Episode 2.
Some of the children did not understand the concept of the horizon; therefore, one girl simultaneously mixed the sea and sky as two-dimensional surfaces. She explained that her bridges were very high and it was too big compared to the buildings and island, so many people could use the bridges at the same time. She also made a deck for reaching boats; however, there was no boat because they might be very tiny size. She understood the concept of scale so that she could compare different scales among different objects and environments. Even though she comprehended the idea of scales, adjusting scales among various objects and their environment during model building was quite challenging for this age of children (Notes on Monday 02. 04. 2012).

Episode 3.
One boy made a greenhouse. There were two different places in the house. There was lots of furniture, as well as drawings and objects on the wall. He was interested in natural materials and used them for the exterior of the house. He built concrete walls and covered them with a dried haze to make them more natural-looking. He used three small glass bottles to represent recycling bins form the recycling of materials, such as paper, cardboard and plastics. He and his father concerned about environmental issues during this building activity (Notes on Thursday. 12. 03. 2012).

Memo 7. The notes of episodes about children's interaction with materials from the preliminary research.

Moreover, the *material study approaches and toolkits* were also integrated into diverse activities with the children. The interactions between the children and materials, both physical substances and toolkits, were illustrated as three different levels: a) the children enjoyed experiencing materials and learning new knowledge; b) the children expressed their thoughts and ideas through materials; and c) the materials helped the adults (i.e. the designers, design practitioners, researchers and educators) understand the children's thoughts during the activities.

As demonstrated by the preliminary research and *Hut-building* practice, the children showed enthusiasm when interacting with the materials, and they learnt new knowledge through these experiments. For instance, the children experienced natural materials, and they simultaneously learned to build constructions, such as tepees, tree houses, tunnels, and domes, out of these natural materials through the *Hut-building* activity. Furthermore, the children had opportunities to pay attention to their surroundings whilst exploring different materials with the *material study approaches and toolkits*. Thus, the children learned about multiple subjects: arts, design, architecture, mathematics, geography and linguistics through the materials.

Children also expressed their ideas and thoughts through materials. As discussed in the Preface, some children were less confident when drawing; thus, they needed alternative ways to present their view. Applying ready-made and fabricated objects may be one way of helping children to represent and depict their thoughts. Furthermore, the *material study toolkits*, *Building blocks*, engaged the children in a comfortable and fast development of ideas.

During the interactions between the children and the materials, associated adults could better understand and interpret children's play, idea development and developmental issues. The *Hut-building* event showed concrete examples of children creating their play with natural materials. On the other hand, the *Tangible ideation* practices, materials–both physical substances and developed toolkits–were intended to trigger children's active learning and participation in their education.

## Materials as a medium

Through the three levels of interaction with and through materials, I constructed the hypothesis that materials could encourage children to embody and develop their ideas. Furthermore, I designed the experimental approach of developing toolkits to enhance the experience of materials (Karana, Pedgley, & Rognoli, 2014; Karana, Barati, Rognoli, & Van der Laan, 2015) for and with children (Lee, 2017b). During the material study practices, *Tangible ideation*, this hypothesis has proven validity in different age groups of children and cultural settings. I have refined the meanings of materials as a medium in this study. I describe the three meanings of materials as follows:

1. ***Materials (substances and toolkits) support constructing ideas:*** In Case 4 *Organic architecture*, the oldest group of children (13–19 years) were participants who were experienced with materials as well as designerly and architectural inquiries. Many pupils had been attending the architectural school for several years, which was deemed an after-school activity. Occasionally, they had worked from sketching to modelling when they undertook projects. In this project, they were requested to explore different materials before they started to construct any models. Many participants commented that studying materials was relevant for brainstorming new ideas and quick ways to appraise the shape and strength of the structure. They agreed that materials supported constructing and developing their ideas (Lee, 2017b). The children implemented similar materials from material collages in the material study session to building models in the implementation session (**Image 43**). Compared to the oldest group, the children from the younger age groups experimented with more diverse materials, even though they would not implement the same materials when they built models. This differentiation has shown that children's different ability to think intellectually is based on their ages (Lee, 2017b).

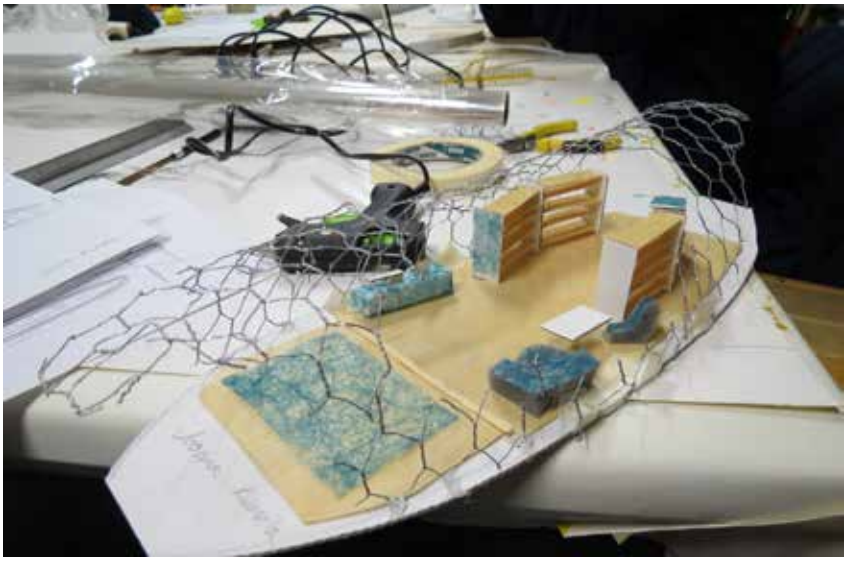


Image 43. The student applying the experimented materials to build models (Lee, 2017b).

2. ***Materials (toolkits) invite participants to develop the curriculum:*** In general, all the participants expressed great enthusiasm about participating in the different activities during the projects. The provided materials triggered children's motivation and participation in the activities. These activities could be formulated as lessons in the primary school curriculum. The classroom teachers from Cases 5 *Dream park* and 6 *Build my city, Helsinki* mentioned that this whole project matched the aims and goals of multi- and cross-disciplinary as well as integrated curricula in comprehensive education in Finland and South Korea. The teacher from Case 5 stated that the workshop had multidisciplinary teaching and learning approaches that included subjects, such as arts, design, architecture, mathematics, geography, literature and English (**Image 44**). She was pleased to have this type of teaching and learning process as well as approach. She incorporated this project into their curriculum, and she was able to teach pupils literacy (through creating stories), mathematics (through measuring), art (through drawing), crafts (through modelling), geography (through displaying on the map) and communication (through discussion) (Lee, 2016).

Image 44. This project integrating various subjects (e.g. arts, design, architecture, mathematics, geography, literature and English) in the primary school curriculum (Lee, 2017b).

3. ***Materials (substances and toolkits) enable learning of new knowledge and skills through practices:*** During the whole practice, children learned through their practice. The adults, both the design expert and classroom teachers, planned the contexts of projects, allocated space and time, as well as provided resources. Students initiated their design projects and made decisions with the guidance of the adults during the design process. In the material study session, participants could experience and explore different materials with their hands. The experimental activities helped children to understand materials and structure, as well as form their ideas into more tangible and feasible shapes (**Image 45 & 46**). Sometimes the children's views did not develop as hoped: for example, some materials were not as flexible as expected. Nevertheless, the children learned new knowledge and skills through the practice. Then, the provided materials, both substances and study toolkits, were adapted to accelerate the learning. The design expert assisted the children in making their decisions using designerly and architectural techniques, including drawing to

scale, finding suitable modelling materials, building the shape and structure, and installing the model. Hence, children's motivation encouraged their active participation in the projects (Lee, 2017b).

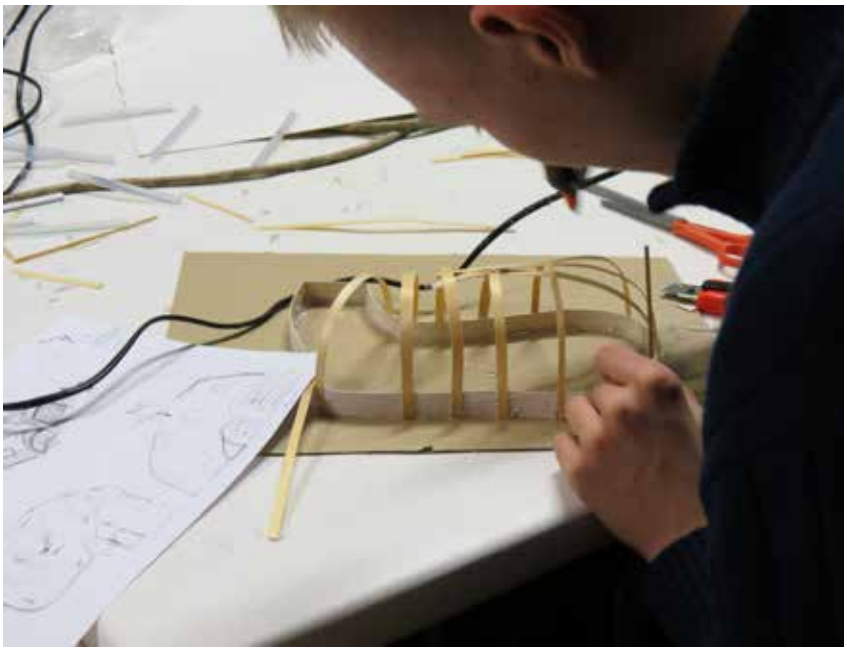


Image 45. Building the structure of an organic building out of wooden veneer (Lee, 2017b).

Adapting the notion of materials as a medium, the three practices rephrased the meanings of materials' in this research. In the *Hut-building* practice, materials were *didactic tools* (Montessori, 1994, 2004) to learn about and teach children about the world, as well as help the adults to better understand children, and build close relationships between the children and adults. Additionally, the findings of this practice suggested hands-on and intuitive materials, in other words, toolkits for children's educational merits. This suggestion has connected the foundational study to the pedagogical practice, *Tangible ideation*. As generative objects, Månen was the material itself, which generated research through design practices. In the *Tangible ideation* practice, materials as *convivial toolkits* engaged children in both extensive material-experience and educational merits.

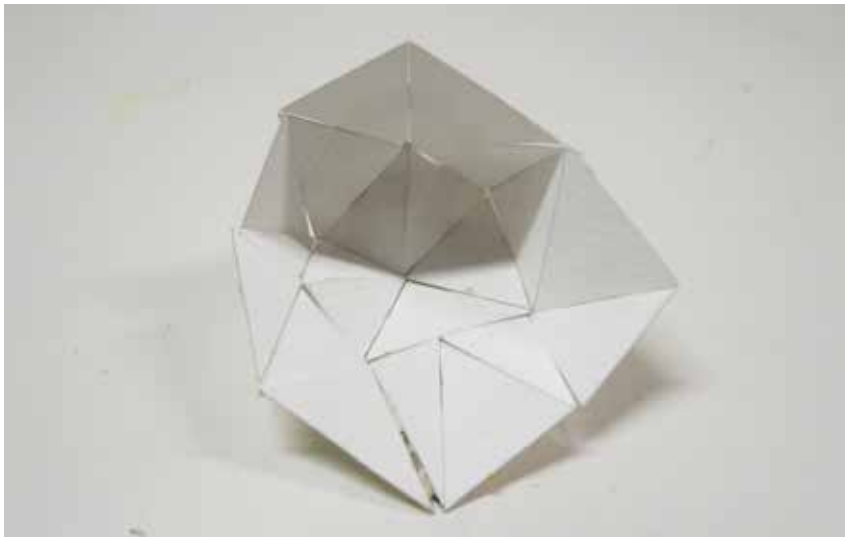


Image 46. Testing to build a polygon type of mock-up out of paper pieces before beginning the real prototype (Lee, 2017b).

# 5.2 Structure

## From the *pedagogical* model

As I have explained, the *Pedagogical* model of practice, *Tangible ideation*, was inspired by Lozanovska and Xu's (2013) *Pedagogical* model and the scholars' experiment, One World, *Two Cities: Black City and White City*. The process comprised three stages: preparation, development of design and installation, evaluation and exhibition in 140 hours during a four-week working period. This research recruited a total of 180 students, including 90 primary school children and 90 architecture university students. However, recruiting that amount of participants and allocating time were challenges when researching in an ordinary primary school curriculum. Therefore, I condensed the structure and instructions enabling them to fit into primary school settings.

As I mentioned in section 1.2, the applied three models introduced by Lozanovska and Xu (2013) divided all the elements into three parts, such as participated subjects (participants) as pink marks, actions (activities or programmes) as green marks and outcomes of the design inquiries

(results) as blue marks. The reviewed models have been applied to several example cases focused on developing architectural and spatial perspectives; therefore, the models required refinement of their processes and approaches in other contexts (**Diagram 14**).

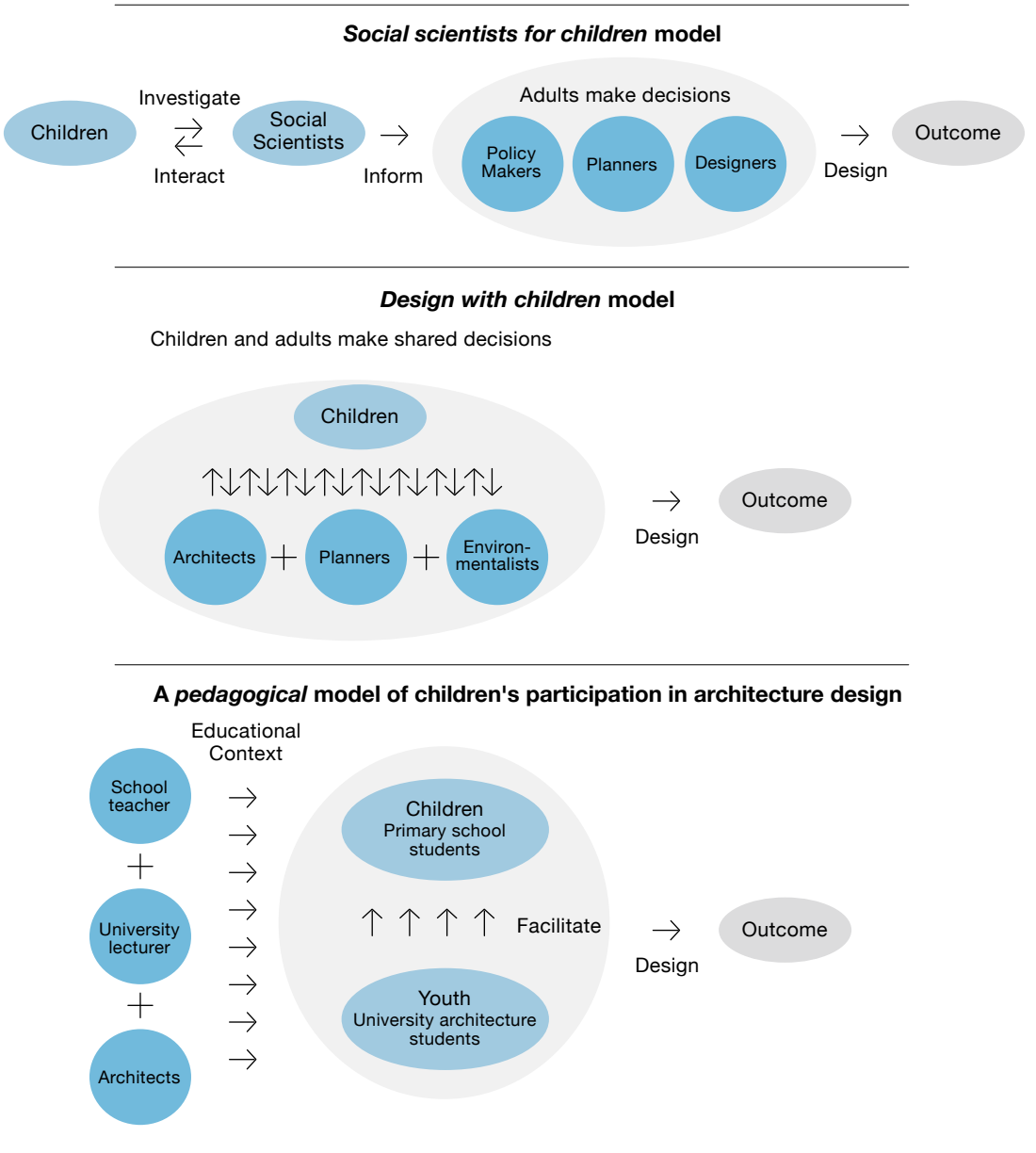



Diagram 14. The three selected models of children's participation and pedagogical approach in architecture design as originally illustrated by Lozanovska and Xu (2013), and the elements of the models in different colours analysed by the author.

The latest *Pedagogical* model, which has claimed to have the most participative approach, needed to elaborate its structure due to considerably defining roles and positions among the participants and the process of the activities. Adapted from this model, I illustrated a new structure of design activity with children in a primary school curriculum (**Diagram 15**). This structure was applied to the pedagogical practice, *Tangible ideation*, with different aged-groups in different settings.

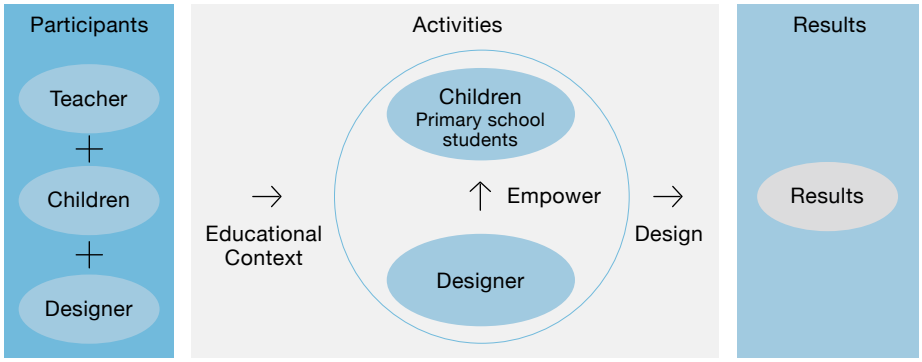



Diagram 15. The primary structure of design activity with children in the primary school curriculum adapted from 'A *Pedagogical* model' by Lozanovska and Xu (2014).

In this research, the new structure of design activities with children refers to two perspectives: 1) a theoretical foundation for PD and co-design activities with children, and 2) the application of designerly techniques in a school context as an alternative way to scaffold learning and teaching in a cross-disciplinary curriculum. This structure has been customised to a primary school curriculum focusing on the participation of children, and direct collaboration between the schoolteacher and designer. Throughout the procedure, this approach has engaged children in their school lessons based on collective creativity, PD and inquiry-based learning. The designer (i.e. design practitioner) played an initial role in empowering the children during the activities. However, it was relevant to ponder the respective roles of different participants, namely, the children, schoolteacher and designer. These respective roles among the participants will be described in more detail later. Through the implementation of this structure in the case studies, this research focused on exploring the following questions:

- What and how is this pedagogical structure created to enhance collaboration between the various participants?
- What are the strategies with which the designer and teacher empower children during the programmes or sessions?
- What are the choices made to propose a universal model, suited to various cultural/pedagogical contexts?

## The structure applied to the practice

The cases in the pedagogical practice followed a similar structure and procedure based on the three steps of processes (Lozanovska and Xu's, 2013): 1) preparation, 2) development of design and 3) installation, evaluation, exhibition. However, allocating periods to each task were different in terms of the schools' timetables, as well as the ages and individual capabilities of the participants. **Table 17** and **Diagram 16** represent the different time allocation between Lozanovska and Xu's practice and Cases 4, 5, 6, 7 and 8 in this research.

Table 17. The time allocation (minutes) among the five different cases.

| | LOZANOVSKA AND XU'S PRACTICE | CASE 4 *Organic architecture* | CASE 5 *Design park* | CASE 6 *Build my city, Helsinki* | CASE 7 *Build my city, Seoul* | CASE 8 *Build my space* |
|---|---|---|---|---|---|---|
| Preparation | 150 | 90 | 15 | 15 | 30 | 10 |
| Development of Design | 300 | 270 | 105 | 105 | 35 | 50 |
| Installation, Evaluation, Exhibition | 390 | 180 | 30 | 75 | 25 | 20 |
| Total working period (min) | 960 | 540 | 150 | 195 | 90 | 80 |

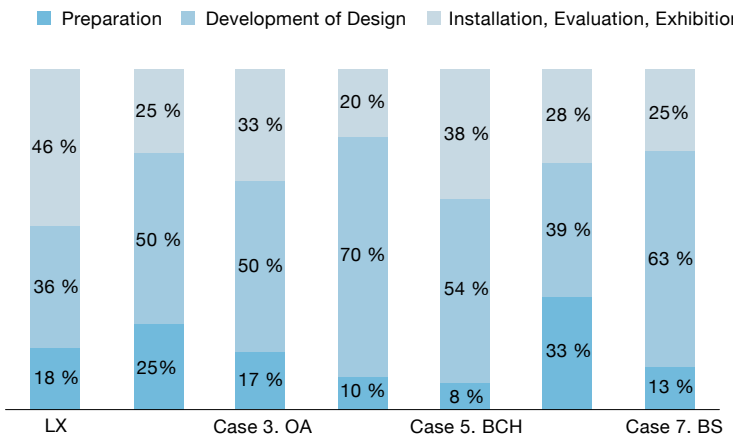



Diagram 16. The time allocation (percentage) among the five different cases.

**Table 15** and the chart in **Diagram 16** have indicated several significant issues in allocating time and creating the structure of the workshops with children. Overall, the five cases were assigned more time for the development of the design stage compared with Lozanovska and Xu's example. Case 5 *Dream park* showed a considerably short preparation period since this case was conducted with the same group of pupils from the previous project, Case 4 *Organic architecture*. With the same participants, Case 4 occurred immediately, after the material exploration session, whereas Case 5 was organised on a different day. By working with the same group of pupils, we were able to avoid time-consuming initial preparations, such as introducing the projects and facilitators to the children, as well as opening the discussion. Instead, we could allocate more time to the actual activities in further stages.

In contrast, Case 6 *Build my city, Helsinki* was also conducted after the material exploration session on the same day, but the preparation time lasted much longer. Since the pupils were very enthusiastic in the discussion, I needed to allocate more time for this activity. Hence, the distinctive cases followed a similar structure and procedure; however, it was relevant to be flexible and ready to adjust them if some of the activities proved to be more engaging and encouraged greater participation from the children.

The three stages of the workshops formed the basic structure of this pedagogical practice. Based on **Diagram 14**, I have elaborated the

structure emphasising the development of the design (programmes) stage as well as interaction among the participants and their roles. Diagram 16 represents the structure as well as depicts the approach and procedure of the pedagogical structure. The structure consisted of sequences around the main action (activity): 1) before the action (preparation), 2) during the action (programmes), and 3) after the action (reflection). The preparation is referred to as the planning stage, requiring the collaboration of the designer and schoolteacher. In this research, the designer primarily set up the plan based on her previous experience of working with children. Nonetheless, it was essential to build collaboration between the design expert and schoolteacher from the beginning until the end of the programmes. The programmes refer to the main actions, and these were also divided into five different phases: 1) introducing, 2) generating, 3) creating, 4) refining, and 5) closing. Namely, the pedagogical programmes comprised of introducing the event discussing, related to contexts, planning design inquiries, conducting the main designerly activities, presenting outcomes, as well as summing up the event with questions and answers. In particular, the main designerly activities meant building models, drawing the models in detail, and writing based on the design outcomes. After the actions, reflection was needed to define the distinctive roles and positions of the participants–the children, designer and teacher–and evaluate the power relationships among the participants. These reflections have supported the development of design implication and improved the quality of teaching and learning, including pupils' educational performance. In **Diagram 17** below, the arrows labelled from A to E illustrate the direction of interaction among the participants. These will be explained in detail in the next section according to the distinctive roles.

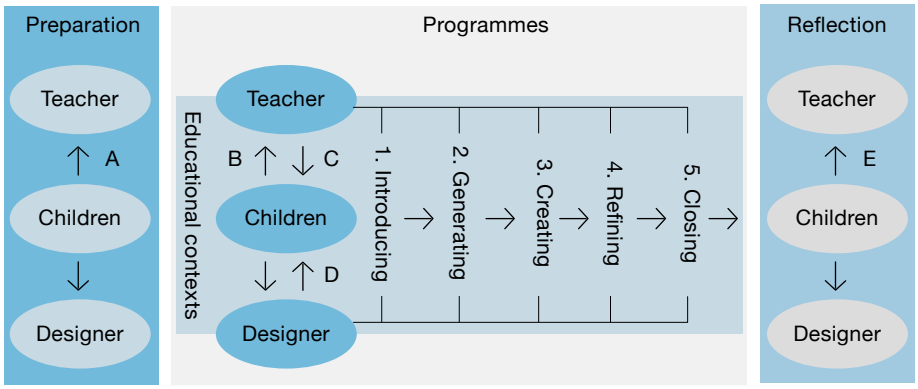



Diagram 17. The structure in designing with children (The empowerment interaction among teacher, children and designer: A. Co-planning; B. Collaborating and (instructional) supporting; C. Engaging and (educational) supporting; D. Motivating, facilitating and accelerating; and E. Evaluating, reflecting and developing).

The design expert and classroom teachers were involved in this research, and they steadily collaborated from the beginning until the end of the projects. According to the feedback from the teachers after the workshops, they were pleased to cooperate with an expert in their school curriculum. In general, they wished to rely on experts' participation in special subjects since the teachers could not cover teaching all areas. However, they mentioned the possible difficulty of finding appropriate experts who would be similarly cognizant of children's learning ability and motivation.

## Different roles of participants in the structure

In the model of practice by Lozanovska and Xu (2013), all the participants performed distinctive roles: 1) children as actual designers, 2) architecture students as recorders, engagers and assistants, as well as 3) adults (i.e. university lecturers and primary school teachers) as provider, supervisor, supporter, intervener, and advisors. First, as the actual designers, the participating children designed playground fragments with support from university architecture students. Secondly, the architecture students encouraged children in their designing. They listened to the children's ideas, transferred their design knowledge to them, and facilitated the design process by using their architectural techniques. They also documented the process by video recording and by documenting in writing to capture the children's creativity, but

they did not interfere in producing the design ideas for the children or attempting to limit their imaginations. Lastly, the participating adults, including the university lecturers and primary schoolteachers, initially set the context of the project, designed the pedagogical programmes, allocated space and times, as well as provided resources. They also acted as supervisors and advisors of the whole project, including acting as interveners when the students had conflicts, uneven power relationships, or difficulties in developing their ideas. Thus, the children needed intellectual and emotional support from the adults (ibid.).

My research was customised to a primary school curriculum focusing on collaboration among the children, classroom teachers and a designer. Compared with other children's participation models by Lozanovska and Xu (2013), the participating children in this research acted in multiple roles, not only as informants and design partners (Read et al., 2005) but also as advisors and decision-makers. The young participants advised and evaluated the material study approach and toolkits applied to the case studies. They were actively involved as designers, as well encouraged to state their opinions and decisions individually and as a group during the whole design process to create their designs. Nonetheless, they were required to follow instruction during the workshops; therefore, the scope of decision-making was somewhat dissimilar among the three cases, Cases 4 *Organic architecture*, Case 5 *Dream park* and Case 6 *Build my city, Helsinki*.

Consequently, the participants (i.e. children, schoolteacher and designer) performed respective roles and positions during the projects. They interacted among the participants and performed their roles in the respective stages. Based on the depiction of each stage of the structure in Diagram 16, the roles and interactions among the participants have been listed below:

- ***Children: Main actors (B), co-developers (B), evaluator (E)***
- ***Teacher: Co-planner (A), assistive facilitator (C), evaluator (E)***
- ***Designer (design practitioner): Planner (A), provider (D), motivator (D), accelerator (D), reflective facilitator (D)***

As described earlier, I as a designer had a role in empowering the children who were the main actors. The designer's roles could be proven more in detail before, during, and after the programme (activities), respectively; and simultaneously interacted with other participants. I acted not only as the primary facilitator, but also performed diverse roles as a planner, provider, motivator, accelerator, and reflective facilitator during the programmes with the children.

1. ***Planner:*** I planned the whole programme based on my design expertise and relied on recommendations about child developmental and pedagogical perspectives from the schoolteachers.
2. ***Provider:*** I ensured children had the spaces and materials needed, whilst simultaneously setting up the educational context for the project. I also provided opportunities for the children to express their thoughts through design activities.
3. ***Motivator:*** I motivated children engaging their participation through open discussions and familiar activities. The open discussions helped children to access the project theme, and the children could execute the project through familiar activities with confidence.
4. ***Accelerator:*** I encouraged children during the activities, which accelerated their motivation and participation.
5. ***Reflective facilitator:*** One of the designer's facilitator emphasised interaction and reflectivity with other participants; later, it was renamed 'reflective facilitator'.

I excluded the two roles of supervisor and intervener (Lozanovska & Xu, 2013) since I concentrated on pupils' active learning rather than supervising the pupils in practice. In addition, I reasoned that the intervention of adults would only be needed when pupils encounter difficulties and conflicts. Purposefully, I emphasised the reflective role of the designer when he or she facilitated activities with children as the designer was required to interact with participants, and simultaneously reflect on the structure and procedures during the activities.

# 5.3 Double triangles and three models of practices

In Chapter 2, I addressed the iterative approach and procedure of this research, designing for and with children. Depicted by two triangles, I illustrated the ways the practitioners have adapted different roles and created products, artefacts or programmes, *designing for* and *designing with*, respectively.

Through this empirical journey, I have elaborated these approaches implying an iterative process and accentuated the design practitioner's (adult designer) roles. Significantly, the design practitioner was able to switch positions and empower other stakeholders' actions during designing *for* and *with* processes. During the process, a practitioner decided his or her positions and roles. He or she reflected on the whole process as well as outcomes among the practitioners, products and practices. The practitioner maintained central roles in the processes, but his or her position might be internally located or externally stretched depending on the different design foci and inquiries. Although the practitioner consistently needed to minimise his or her roles, this reduction differed from underestimating or devaluing the contribution and reflection. Rather a part of the practitioner's roles might transit to other stakeholders, mainly children and partially educators as well as other adults working with children. In the process, the practices (i.e. making and acting) also synchronised with their occasions and settings. Furthermore, created products, (i.e. materials, artefacts) and a structured programme, were implemented in and evolved with each other through the practices (**Diagram 18**).

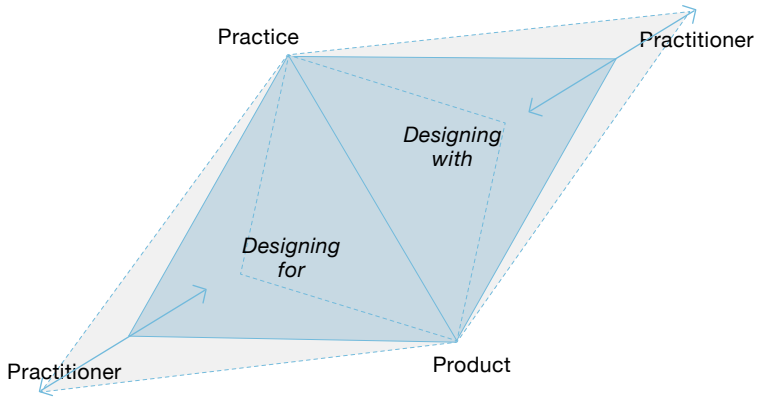



Diagram 18. Double triangles depicting the iterative approach and designer's role in designing *for* and *with* children.

As noted at several points, this research has adopted three models: *Social scientist*, *Design with children* and *Pedagogical* models, which are based on a critical review of children's participation by Lozanovska and Xu (2013). In this dissertation, these three models have been adapted and implemented in the respective practices involving children in the design process. The cases have involved different design products being tried for each programme. They were undertaken in different locations and times in Finland and South Korea from 2012 to 2016. The first practice, *Månen*, demonstrated an approach combining product development with children as well as activities involving the application of the product (designing with children approach). The second practice, *Hut-building*, focused on understanding children's participation and collaboration during their activities through an ethnographical study (social science approach). This model has changed the term as social science, rather than social scientist. The last practice, *Tangible ideation*, concentrated on exploiting the materiality and structuring of design activities with children (pedagogical approach). Based on these three practices, I have sought to explore the research questions with these criteria.

*Månen* evolved its focus from developing products to conducting activities (programmes) with children. In this first practice, I engaged in *designing for* children and *designing with* children, as well as emphasised the iterative relationships of these approaches within two

triangles–Diagram 19 depicts the iterative approach between *design for* children and *design with* children. Thenceforth, I described the transition from one to another approach by addressing its concurrent and iterative features, and reaffirmed the designing for and with children approach in this research (**Diagram 19**).

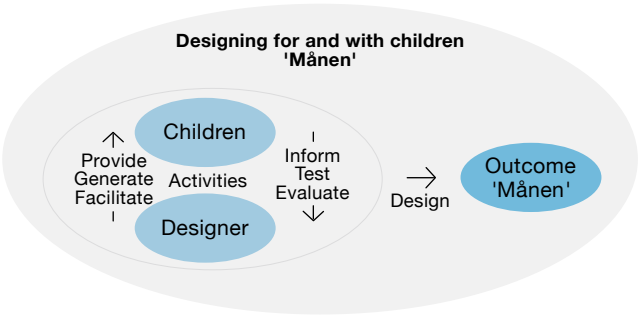



Diagram 19. *Design* for *and* with *children model.*

Whilst conducting activities in this model of practice, children and the adult designer played different roles. The children were acquainted with the field of design inquiries. They tested and evaluated both the design process and outcomes. In addition, an adult designer provided the children design inquiries, as well as generated and facilitated the activities to encourage children's participation in the design process. Significantly, the children and adult designer shared ideas as well as the decision-making on the outcomes.

*Hut-building* was an observational study based on design ethnography. This research provided opportunities for adults to access the children's world, as well as paid increasing attention to children's voices and rights, including their participation and collaboration during physical activities. The study focused on exploring children's collaboration, building relationships among young participants and adults, as well as adults' intervention during the activities. The observation indicated that children's collaborative work potentially revealed their views and needs in their social lives and capabilities. Furthermore, the interaction between children and the designer was a foundation of fundamental understanding as well as a way of building trust and relationships to undertake design activities initiated by the children's participation (**Diagram 20**).

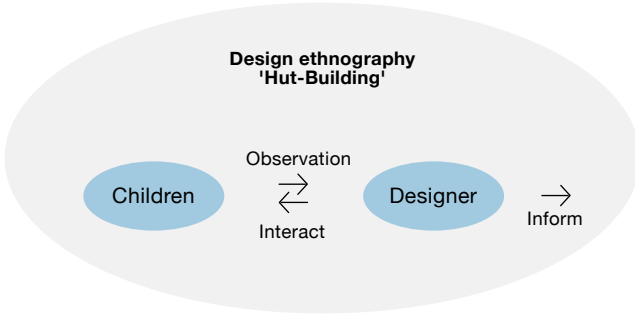



Diagram 20. S*ocial science for children* model.

*Tangible ideation* proposed a teaching and learning model of practice, which evolved through designerly and architectural educational projects. This research aimed at collaborating with children to develop *material study approaches and toolkits* for children and youth, and to propose a multi- and cross-disciplinary, as well as integrated teaching and learning approach, to the primary school curriculum. An analysis of the process and the results of the research revealed that *material study toolkits* were a great benefit to children in recognising materials, enjoying a tactile experience and developing ideas (**Diagram 21**). This approach was realised by collaboration between a teacher, children and designer. In this approach, the designer adopted various responsibilities to motivate children's participation, facilitate activities and accelerate the whole process. The positions of the 'Teacher' ellipse were positioned near the 'Designer' since the 'Teacher' would assume a substitute role supporting the 'Designer's'.

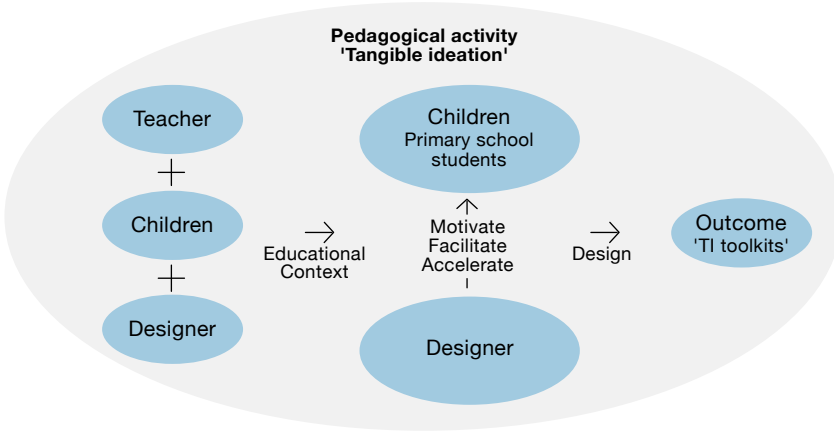



Diagram 21. *Tangible ideation (Pedagogical/design educational)* model.

These three models of practices have addressed different proceedings and features involving children in the design process. I suggest implementing these three models of practices in the following circumstances:

1) *Design* for *and* with *children* model: Professional design-focused, outcome- & process-focused circumstances
2) *Social science for children* model: Initiative stage of design-focused, research-focused circumstances
3) *Tangible ideation (Pedagogical/design educational)* model: Education-focused, process-focused circumstances

However, these three models of practice were closely related to each other. For instance, the *Social science for children* model would be a foundation on which to structure *Design* for *and* with *children* and *Tangible Ideation (Pedagogical/design educational)* models. In addition, the latter approaches would provide practical skills and toolkits to assist in *Social science for children*. Designers could adopt any of these approaches appropriated to design inquiries and situations. They could implement the techniques and skills from different approaches based on reflections through practices working with children.

## 5.4 Progress and new findings in Chapter 5

Throughout the models of practices, I have identified two focal points: materials and structure in designing *for* and *with* children. First, the materials have been the focus of the practices. Initiating the first observational study on indoor activities of children, materials were the point of interaction when working with the children. In the *Hut-building* practice, the materials have continued to be implemented to understand children, in particular, their play and participation during the activities. Furthermore, materials have become the main content of the pedagogical practice for different ages of children in the *Tangible ideation* practice. From these models of practices, I elaborated on the distinctive meanings of materials as a medium: 1) supporting constructing and articulate ideas, 2) inviting participation in developing the curriculum, and 3) providing learning new

knowledge and skills through practices. Whilst working with children, many designers and researchers have occasionally applied educational activities to promote both children's merits and research aims. These activities have followed a similar structure for the pedagogies. Secondly, based on Lozanovska and Xu's (2013) *pedagogical* model, I have demonstrated and evaluated this pedagogical structure of activities with children through the *Tangible ideation* practice. Synchronising the earlier findings and the practices, I have concentrated on discussing the structure of activities with children. As the basis of this research, I introduced two triangles to describe the iterative process and elements in Designing for and Designing with children in Chapter 2. Finally, this diagram of the structure has evolved, and I have claimed a new framework for designing for and with children.

Mutual understanding and learning between the design practitioner (adult designer) and children were the focal purpose in this research. The practices of working with children throughout three approaches provided both parties with opportunities within the contexts of designing *for* and *with* children. The children possessed opportunities to express their thoughts and perspectives through the provided materials and activities. Simultaneously, the practitioner could access their world and gain a thorough understanding of their voices and thoughts through outcomes and practices. The products referred to both outcomes created by the children, and the kind of toolkits created and provided by the design practitioner during the activities. 'Materials' were the medium through which all of the developments were proposed for *PD for and with children*. These were the dialogue between 'products' and 'practices'. The practitioner's roles have been positioned before, during, and after the process, within which his or her key role was to reflect the process and outcomes through the three practices of *Månen, Hut-building*, and Tangible ideation. This reflection was an indubitably relevant phase to accomplish the entire research as well as inform any forthcoming procedure and further studies (**Diagram 22**).

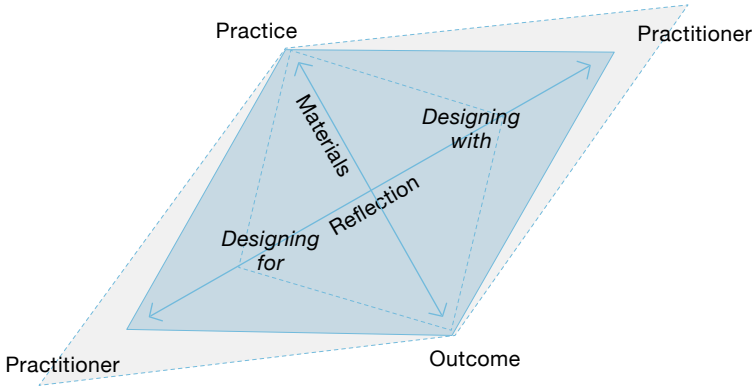



Diagram 22. The iterative approach, positioning materials and designer's reflective roles in designing *for* and *with* children.

In Chapter 6, I will point out the respective roles of children and adults in designing *for* and *with*. To focus on the importance and contribution of the adult designer (i.e. the design practitioner), I concentrated on discussing the different roles of the associated stakeholders in the *Pedagogical/design educationa*l model of practice. Within these practices, the children performed as the main actors and developers rather than the designers, with the adult designer being in charge of multiple roles as a planner, developer, provider, motivator, accelerator, and reflective facilitator at different stages. In her key role, the designer mainly empowered children and included schoolteachers in the design practices. Furthermore, the designer performed the role of a supporter rather than an authoritative operator.

# 6.1 Contributions to Interaction Design and Children / Child Computer Interaction and Participatory Design

This research contributes to current IDC/CCI and PD research by critically discussing these research results in relation to the existing work reviewed earlier. This research has focused on two different contributions: within a professional design practice context and within a pedagogical/design education context. It should be noted that PD has primarily been used to support designing for and with children in this research. Furthermore, the different uses of 'materials' have been showcased in each practice in both contexts. Within a professional design practice context, 'materials' have been employed as stimuli and generative objects for the PD sessions with children. Materials engage better communication between adult designers and children. As the same time, within a pedagogical/design education context, 'materials' have been utilised to stimulate children's thoughts, ideas, and concepts. Consequently, 'materials' and PD method support children's active motivation and participation in their education.

In the *Design* for *and* with *children* model of practice, materials have been implemented as stimuli and generative objects to engage better communication between the design practitioner and children. As the design artefacts, i.e. products, the materials had been designed from the previous PD activities with children, after that, these have been implemented into further activities, thus formulating the iterative process. Differing from the existing work in IDC/CCI and PD domain, the materials were non-digital products, which could be used both as the final outcomes and generative objects for the further PD activities with children. In the *Social science for children* model of practice, the materials were easily available and accessible to the children, fuelling their creativity and imagination in both free-play and structured-play, as well as creating new objects in a designerly manner. In the *Tangible ideation* model of practices, children have interacted with physical materials and toolkits to learn about material properties and sensorial qualities, as well as

improve their materials' experience. However, learning is one of the key principles in PD and clearly has an impact on child development; therefore, I also designed cases within a pedagogical/educational context.

The structure of activities with children during the studies could be implemented by other designers and researchers working for and with children. I suggested three models of practices for different circumstances of working with children: 1) *Design* for *and* with *children* model for the professional design-focused and outcome- & process-focused circumstances, 2) *Social science for children* model for initiative stage of design-focused and research-focused circumstances, and 3) *Tangible ideation* (*Pedagogical/educational)* model: Education-focused and process-focused circumstances.

To address the relations between this research and IDC/CCI and PD research, current design practices and research involving children commonly arrange adults and children in small numbers in one group; consequently, a limited number of children have opportunities to participate in design or research projects. In contrast, this research provides a more reasonable structure and guidance for the adult designers and researchers working with larger groups of children. In addition, this research offers less pressure to recruit child participants because it collaborates with school children. This has been integrated into the school curriculum, ensuring that children also receive educational merit through design-based learning (Bekker *et al*., 2015; Smith & Iversen, 2015; Eriksson et al., 2018). Furthermore, these presented PD activities could be set as an independent programme for children in different circumstances and contexts. However, activities in IDC/CCI communities and PD sessions are seldom implemented in other contexts. Consequently, this pedagogical practice engages in a separate structure and implementation of activities.

## 6.2 Adopting roles

Through my cases in three practices, the associated stakeholders (i.e. children, teachers, and designers) performed respective roles in the design process. In the child-related design domains, the roles of children have been highlighted and defined (Scaife *et al*., 1997; Druin,

1999; Kelly *et al*., 2006; Barendregt *et al*., 2016; Iversen, Smith, & Dindler, 2016; Kinnula *et al*., 2018). Hence, adults' roles have also been discussed in terms of engaging and empowering children's participation. However, the significant contributions of adults' roles have occasionally been less acknowledged when compared with the children's roles. In this section, first, I discuss the different roles of the associated stakeholders during the three practices: 1) *Design* for *and* with *children* model of practice: *Månen*, 2) *Social science for children* model of practice: *Hut-building*, and 3) *Pedagogical/design educational* model of practice: *Tangible Ideation*. Furthermore, I emphasise the adult designer's roles in encouraging children's participation, particularly focusing on their primary education. These claims are expanded on in the design practitioner's roles when designing *for* and *with* children.

## Reflection on children's roles in the practices

According to the descriptions of children's roles by Northumbria University, I have reflected on the children's roles within the three practices (**Table 18**).

The young participants in the *Månen* practice played various roles in different developmental stages. At the beginning of the project, children were invited to inspire the design practitioner in two design workshops for developing playful physical design outcomes. As a designer, I reaped many benefits throughout these activities. Some of the benefits included gaining insight and inspiration during and after the workshops, as well as defining the design concept to develop the design outcomes and for further development. Hence, the children played their parts as creative inspirers; however, they later switched into being testers of the prototypes and, eventually, users of the products. Their roles could also be positioned as trailblazers due to their perspective and concentration on developing and creating prototypes, thus envisioning future design possibilities.

The participants in the *Hut-building* practice mainly performed as *builders* to construct huts during the event. Additionally, they were *clients* to whom were provided educational opportunities to learn ways of building constructive structures with natural materials. Despite my expectation of the children's being more actively involved during the activities, we have seen how their participation was rather limited and uneven depending on the group of children.

Table 18. The different roles of children and adults in Lozanovska and Xu's (2013) models and the three practices in the research.

| MODELS | | ROLE OF CHILDREN | ROLE OF ADULT(S) |
|---|---|---|---|
| Lozanovska and Xu's models | *Pedagogical* model | Actual designers, decision-makers | University lecturers and primary schoolteachers: providers, supervisors, supporters, interveners, advisors<br>Architecture students: recorders, engagers, assistants |
| | *Design with children* | Informants, partners, decision-makers | Facilitators |
| | *Design by children* | Active designers and planners | (Ignored the adults' input) |
| | *Children's voice* | Advisors | Researchers |
| | *Social Scientists for children* | Research subjects | Scientists and researchers |
| *Design* for *and* with *children* model of practice, *Månen* | | Creative inspirers, decision-makers, testers, users, trailblazers | Designer, decision-maker, facilitator |
| *Social science* model of practice, *Hut-building* | | Builders, clients | Planner, provider, instructor, participant observer (researcher) |
| *Pedagogical/design educational* model of practice, *Tangible ideation* | | Main actors, co-developers, co-evaluators | Designer: Planner, developer, provider, motivator, accelerator, reflective facilitator<br><br>Teacher: Co-planner, assistive facilitator, co-evaluator |

In the *Tangible ideation* practice, the children had also adopted roles similar to those of *trailblazers*. They were involved in developing and creating tangible toolkits to enhance children's *materials-experience* (Karana, Pedgley, & Rognoli, 2018, 2013, 2014). Later, these developed prototypes (toolkits) were implemented to envision the new space, such as cities or space. For instance, from the initial results in Case 6 *Build my city, Helsinki*, Case 7 *Build my city, Seoul* and Case 8 *Build my space*, adults (i.e. designers or researchers, teachers) obtained the pupils' insights on future spaces. The children participating in the project were informed that they were involved in demonstrating and developing processes. Differentiating from the role of trailblazers, these toolkits have possessed other functions: triggering a better

understanding of children's perspectives as well as generating children's idea development and participation in the research inquiries. Therefore, I could add *placemakers* as another extensive role of children in particular in Cases 4 *Organic architecture* and 5 *Dream park*.

In Chapter 5, I defined the roles of children in the pedagogical practice as *principal actors, co-developers, and co-evaluators* when I described the different roles of participants in the structure. This definition was focused on the activities and their structure as well as related to the adults' roles in the practice.

## Adults' roles in the practices

To respond to the second question in this discussion chapter, I describe the different roles of stakeholders/adults/practitioners in the dissertation, which differ from that which is already known within these areas of research. The adult designers/practitioners have adopted flexible and multiple roles, such as *planner, provider, motivator, accelerator* and *reflective facilitator*, in designing *for* and *with* children:

- ***Planner:*** I planned the whole programme based on my design expertise and relied on recommendations about child developmental and pedagogical perspectives from the schoolteachers.
- ***Provider:*** I ensured children had the spaces and materials available needed, whilst simultaneously setting up the educational context for the project. In addition, I provided opportunities for the children to express their thoughts through design activities.
- ***Motivator:*** I motivated children by engaging their participation through open discussions and familiar activities. The open discussions helped children to access the project theme, and the children could execute the project by the familiar activities with confidence.
- ***Accelerator:*** I encouraged children during the activities, which accelerated their motivation and participation.
- ***Reflective facilitator:*** When I facilitated the activities, I emphasised interaction and reflectivity with other participants; later, it was renamed 'reflective facilitator'.

In addition to the adults' roles, the teacher acted as *co-planner*, *assistive facilitator*, *co-evaluator* to assist the design practitioner during the activities. Table 17 above presents the different roles of children and adults in the Lozanovska and Xu's (2013) models and the three practices: *Design* for *and* with *children* model of practice, *Månen; Social science for children* model of practice, Hut-building; and P*edagogical/design educational* model of practice, *Tangible ideation*, in this research.

## 6.3 Different roles of participants and relationships

### The collaboration among child participants

Children's participation is an iterative process consisting of their involvement, motivation and competence. This has the advantages of developing individuals' competence and confidence, as well as improving the communities (Hart, 1992). To ensure genuine participation by the children, there are some important requirements to carry out the projects in terms of the children's understanding, awareness, roles and freedom of participation (ibid.). Participation not only provides children with chances to have their voices heard, but it also enables them to learn that others also have their voices that should be heard. They concede to the others' rights, thus enabling them to adapt to any differences in opinion; therefore, participation leads children to actively collaborate in society (Lee, 2016).

Children's participation and collaboration have been regarded as the focal points when undertaking this research. When children have been delegated ownership in a project they are involved in, then, they have more motivation to work on it to its conclusion. This motivation fosters competence, which yields more motivation for further projects. In this process, adults not only need to guide children, but the children also need to learn valuable and developing concepts (Hart, 1992). For this reason, I have sought to engage children in participating in the activities and enhancing their collaboration. In this section, I have addressed significant findings in unique collaborations among different parties and connected these

collaborations to engage children's participation in various settings throughout the three practices.

From this observational study in the Hut-building practice, I discovered different levels of children's collaboration:

1. ***Adult-initiated collaboration:*** this occurred between children during work on given tasks, such as carrying materials, holding up a structure or tightening components. To achieve the assigned tasks, the adult instructor needed to encourage collaboration among the children. In these instances, the children had less motivation and no desire to work.
2. ***Child-initiated and directed collaboration:*** this collaboration was initiated by a child to encourage his or her peers to work; for example, one girl compared both sides of the weaving work, and then she asked her friends to work on one side, which had been worked on less: she evidently wanted to balance out the outcome. The children participating demonstrated a little more motivation and enjoyment in contrast with these doing tasks directed by adults.
3. ***Children-initiated and directed collaboration:*** this collaboration simultaneously occurred among the children and spontaneously continued. It demonstrated high motivation and lasted more extended period with more pleasure compared with the other collaborations (Lee, 2017a).

## Between the design practitioner and children

In the *Månen* practice, the children were invited to participate in the design from the early stage of ideation to the final product development. Overall, they performed notable and multiple roles during the whole design process. Through this practice, I could explore collaboration between the design practitioner and children in the actual practice to develop the physical product for children. The participation of children was a critical point in succeeding in designing physical products. At the same time, the designed products encouraged children to participate in further activities related to the products. Consequently, the outcomes and activities have displayed certain features, such as being playful, generative and

educational, to engage children's participation in design practices and children's education. These features have been implemented in the pedagogical practice.

In *Tangible ideation* practice, the adults set the context for the project, in that they designed the educational programmes, allocated space and time, and provided resources. During the design process, the pupils initiated their design project and made decisions with the help of the adult facilitators. The pupils were authorised the freedom to make decisions related to the design (e.g. the shape, the size, the material, and the location of the building), whilst the adult facilitators supervised them to help realise their decisions using design and architectural techniques and languages (e.g. drawing to scale, finding the suitable modelling materials, building the shape and structure, and installing the model). Therefore, this practice achieved high levels of genuine participation from the children in their education (Lee, 2016). Simultaneously, this provided the design practitioner with concrete opportunities to explore various PD techniques with a wide range of children in their environment.

## Between the design expert and educators

Collaborative teaching and learning emphasise mutual influence and equal participation. This type of learning has increasingly provided opportunities for the development of intercultural competence (Lahti & Seitamaa-Hakkarainen, 2005), whilst collaborative teaching between a teacher and an external domain expert has deepened the quality of education and led to positive effects both for the teacher and the expert (Kangas, Seitamaa-Hakkarainen, & Hakkarainen, 2011).

When carrying out my interviews, several schoolteachers mentioned their enjoyment in occasionally collaborating with experts in the classroom. Teachers were not averse to having experts participate in their class-teaching for particular subjects, because they were aware that they could not cover all areas in their teaching. However, they admitted that it was not a simple matter to locate experts who were also capable of adapting to children's learning abilities and moods. Nevertheless, the teachers showed a willingness to collaborate with

experts. Throughout the *Tangible ideation* practice, as the design expert, I regularly collaborated with the teachers from the beginning to the end of the projects. Indeed, it was vital to communicate to consistently respect others' expertise, and for the experts and educators to reflect together on the means of teaching collaboratively.

## Different roles of participants and power relationships

For several decades, the transitioning roles of designers has been discussed in design and research. In the User-Centred Design (UCD) process, designers and researchers have studied users to understand their needs and requirements. They have provided knowledge from theories and developed more knowledge through traditional research approaches, such as observation and interview. In comparison with the UCD approach, in co-design, designers and researchers have provided tools for ideation and expression for stakeholders, their design skills are essential in developing the tools. Moving forward to engaging and empowering users, designers or researchers have shifted from their former roles of being translators to facilitators to assume more responsibility (Sanders & Steppers, 2008). In a similar vein, Lee (2008) has also pointed out three new designer roles: design developer; design facilitator, and design generator (ibid.). Furthermore, she has emphatically addressed different design participation developments: the aesthetic quality of design practice, the collaborative relationship between design research, and participatory design thinking (ibid.).

As mentioned earlier, the roles of children have been highlighted in diverse domains in research and design; however, the significance and contribution of adults' roles have received far less attention than the children's. Table 16 presented the different roles of children and adults in Lozanovska and Xu's (2013) models as well as the three practices in this research. In particular, Lozanovska and Xu's (2013) pedagogical models and the *Tangible ideation* practice emphasise adults' multiple roles during the activities with a pedagogical structure. To achieve satisfactory procedures and results, appropriate power relationships should be balanced among different participants prior to the activity beginning.

From the findings of the *Hut-building* practice, it is essential to respect the participants to build a desirable relationship between an ethnographer and participants. During the photographing and video recording, some of the children did not want their images or video to be shown. Therefore, if they express such opinions or reactions, any visual documenting should immediately cease. Other children enjoyed having photos taken of them and their creations; indeed, one child was eager to see these photographs and video recording of him and directly requested access.

In addition to relationships between children and adults, it can be an opportune moment to build a better relationship when a child confides his or her self-perceived lack of skill at specific tasks. During my practices, the children had considerably more motivation and enthusiasm when they worked on a task for which they had some competence. On this occasion, the children needed adults' support and encouragement. From the failure of collaboration between the adult instructor and children, this research can provide adult designers and researchers with tactics for successfully organising activities for children and working with them (Lee, 2017a).

## 6.4 Translating the empirical findings into the pedagogy practice

According to Cross' (1982, 2001) theoretical influence on this research, the first observational study was conducted to investigate interaction and exploration between children and materials as substances. Afterwards, tactile materials, namely *material study approaches and toolkits*, were developed with different age groups of children. The materials have been utilised with one age group of children (fifth graders) to enhance their tactile learning and experiences in two different primary schools in Finland and South Korea. Therefore, this research provided children with tangible opportunities to learn designerly ways as well as the skills for solving problems and generating ideas. In particular, the skill of solving problems was integrated into the children's education. The principles of the *Designerly ways of knowing* with

children will be elaborated on and refined in this section as the educational merits of PD with children.

In the *Tangible ideation* practice, the *material study approaches and toolkits* supported multi- and cross-teaching as well as learning approaches. These could be integrated into diverse subjects in child education. However, the *material study toolkits* were distinctively selected and applied to different settings; therefore, the evaluations focused on the characteristics of the toolkits, rather than comparing them with the collected data.

Based on the preliminary research of interaction and exploration between children and materials, this research introduced the *material study approaches and toolkits* to foster children's tactile learning and experiences. These provided children with tangible opportunities to learn designerly ways, the skill of solving problems and generating ideas. For instance, one pupil rapidly began creating and developing his ideas with the Building blocks, which were one of the *material study toolkits*. However, the construction of the output lacked a suitable structure to support itself. Later on, the pupil modified the final model by adding a supportive structure (**Images 47 & 48**).

Image 47. Pupil engaged in creating his output structure with mixed success: The pupil agilely initiated creating and developing his ideas, but the structure of output was not sufficiently strong to stand on its own (Lee, 2016).

Image 48. An example of pupil problem-solving: The pupil practiced problem-solving with the materials provided, and the final model was elaborated adding a supportive structure (Lee, 2016).

Namely, these materials proved that designerly skills could be integrated into children's education. The five principles of the *Designerly ways of knowing* (Cross, 1982, 2001) were developed to work with children in this research:

1. Children rapidly and easily tackled 'ill-defined' problems through the use of materials
2. Children could immediately experience problem-solving by using the materials
3. Materials helped the children's constructive thinking
4. Children learnt to implement starting from an abstract requirement into concrete objects through materials
5. Materials assisted children in presenting their ideas and thoughts (Lee, 2017b).

The materials between a person and their surroundings help them to make sense of the world. Adopting the notion of 'Material as a medium' (Kuusk, Wensvenn, & Tomico, 2016), materials can connect

children and their world. These provide children with opportunities to be aware of, to participate in, and to learn through tangible ways. In other words, materials support children to constructively develop their ideas, engage them in participating in their education fully, and teach new knowledge and skills to children through three practices in this research. During these interactions, designers facilitate the practices or activities to enhance more available communication between children and the opportunities available (Lee, 2017b).

I envisioned and implemented three stages during the activities, and these stages formed the basic structure of this pedagogical practice. I elaborated on the structure emphasising the development of the design (programmes) stage as well as interaction among the participants and their roles. The structure consisted of sequences around the main action (activity): 1) before the action (preparation), 2) during the action (programmes), and 3) after the action (reflection).

The preparation is referred to as a planning stage, requiring the collaboration of the designer and schoolteacher. In this research, the designer primarily set up a plan based on her previous experience of working with children. Nonetheless, it was essential to build collaboration between the design expert and schoolteacher from the beginning until the end of the programmes. The programmes refer to the main actions, and these were also divided into five different phases: 1) introducing, 2) generating, 3) creating, 4) refining, and 5) closing. Namely, the pedagogical programmes comprised of the introduction of the event, discussion related to contexts, planning of design inquiries, conducting the main designerly activities, presenting outcomes, as well as summing up the event with questions and answers. In particular, the main designerly activities meant building models, drawing the models in detail, writing based on the design outcomes. After the actions, reflection was needed to further define the distinctive roles and positions of the participants – the children, designer and teacher – and evaluate the power relationships among the participants. These reflections have supported the development of design implication and improved the quality of teaching and learning, including pupils' educational performance.

# 7.1 Main contributions of this research

In sum, the practices resulted in defining the meaning of materials, iterative approach, and pedagogical structures of designing *for* and *with* children. Through this whole process, this research finally provided a new framework of designing *for* and *with* children, and accentuated the adult designers' (i.e. design practitioners) roles. Furthermore, the mutual learning between the adult designers and children has been highlighted in this research. In this section, I address the main contributions in the respective practices, as well as consolidated issues and findings (**Diagram 23**).

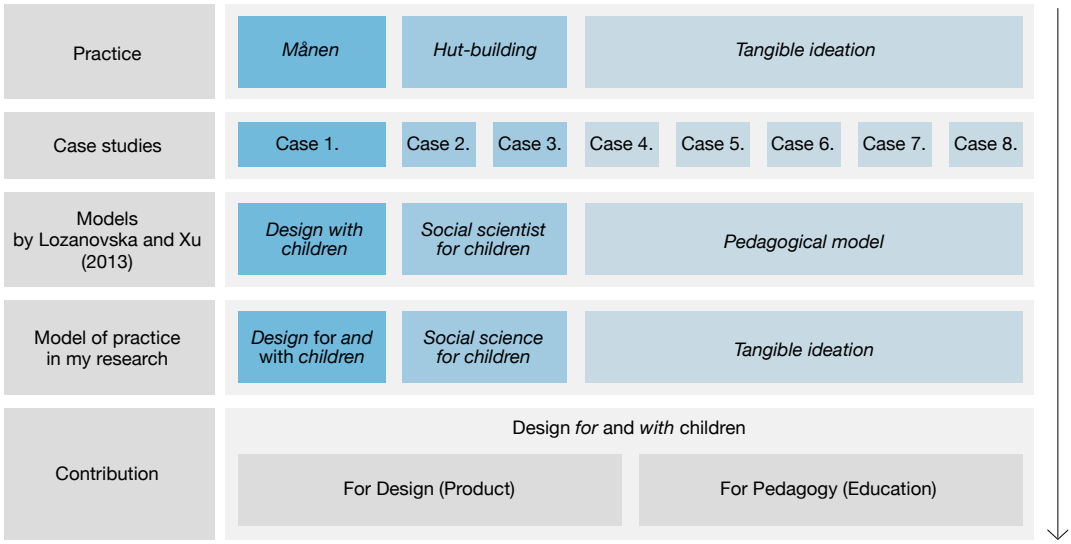



Diagram 23. The main contributions of this research.

Through the *Design* for *and* with *children* model of practice, *Månen*, the participatory approach applied in the actual product development project with children has proven its merits to both the children and adult designers. This entire journey represented the iterative process between *designing for* and *designing with* children. This practice initially created the framework of this research. Beginning with the observational study of the children's outdoor activity in *Hut-building*, this research examined the novelty of the designer

applying ethnography to understand of children's participation and collaboration, as well as expedite providing design opportunities. Young people were naturally interested in natural materials, and possessed a great enthusiasm to create their toys and games. This natural interest provided opportunities for tactile and sensory education as well as physical, natural and social games, which were essential to children. Based on the findings, the *material study approaches and toolkits* for children were developed in the forthcoming cases in *Tangible Ideation*. This *Tangible ideation (Pedagogical/design educational)* model of practice contributed to fostering children's materials-experience in their education. As a medium, materials supported children to rapidly and efficiently develop as well as express their ideas, to actively engage children's participation in their school curriculum, and to adaptively provide them with opportunities to learn new knowledge and skills through activities (practices) based on *Designerly ways of knowing*.

To move forward to create the foundation of my initial claim, I have discussed the iterative and spontaneous approach of Designing *for* and *with* children, *Månen* in two triangular diagrams. The three elements: the role of practitioners, practices and product mirror each other. The practitioners have switched their roles concerning the practices, and have revealed these roles through the practices, and produced the products. Based on this foundation as well as the features and principles of generative objects, I developed design toolkits to enhance children's material study in their primary education. In addition, the design activity formulated the structure of *Pedagogical/design educational* model of practice, *Tangible ideation*. This structure was revised and discussed in depth. Furthermore, the guidance and challenges discovered have been synchronised with the findings from other practices working with children, and presented with the designer's roles.

In the *Hut-building* practice in Chapter 3, I examined the novelty of the designer applying ethnography in settings working with children. The practice provided both adults and children with opportunities within the contexts of designing *for* and *with* children. These opportunities included essential features and relations among the three elements of ethnography: people, artefact and activity. The adults provided children with opportunities to experiment with

different activities. The children expressed their thoughts and perspectives through the artefacts they created. Through the created artefacts and conducted activities, the adults received opportunities to gain accessibility and a thorough understanding of children. As described earlier, **Diagram 6** summarised the relations of the three elements of ethnography and extensive opportunities in the contexts of *for* and *with* children. Namely, the opportunities were provided at different levels with different directions among the people (children), artefact, activity and designers. Thus, the roles of the designers (design practitioners) were thoroughly considered within the process of these practices. Simultaneously, the designers have bridged gaps of understanding, respect and relationships between adults and children through ethnography. Therefore, the designers' roles helped to form the initiative and foundation of PD with children.

In the *Tangible ideation* practice in Chapter 4, elaborating on Lozanovska and Xu's (2013) pedagogical model and practice, this research formulated pedagogical practices with school-aged children through design activities in various settings; therefore, this enhanced children's materials' experience and explored values of design in their education. During these practices, the children could develop their materials' knowledge, values and skills through active learning practice. In particular, the materials' knowledge (in the material exploration sessions) propositionally merged into real-world contexts through the children's design activities (in the material implementation sessions). Hence, the propositional and the empirical knowledge of materials as well as design were interconnected and balanced (Pedgley & Sener, 2017).

Throughout these practices, I developed the *material study approaches and toolkits*, as well as shared my initial findings on working with different age groups of children, balancing the working atmosphere in activities with children, focusing on integrated teaching and learning, and considering the adaptability of this approach in different cultural settings. In Chapter 5, I synchronised these significant findings among earlier studies and the cases in this practice, identifying three issues: the material matters, structure, and framework of this research.

This research provided a pedagogical structure in design activities with children through the practices in primary school settings. The structure consisted of three phases: *preparation, programmes,* and

*reflection*. The first phase, preparation, referred to initiative planning. The second phase, programmes, referred to the main activities with these also being divided into five different stages: 1) introducing, 2) generating, 3) creating, 4) refining, and 5) closing. The last phase, reflection, occurred after the main activities. It involved defining the distinctive roles and positions of the participants, evaluating the power relationships among the participants during design implementation, improving teaching and learning quality, as well as rating pupils' educational performance. This structure was distinctively customised to the primary school curriculum with the intervention of a single design expert and schoolteacher, rather than the involvement of many adults. It relied on a compact and effective application of the structure in the practices. The stages were assigned working periods depending on the types of tasks and could be eliminated. The implementation in different settings proved to be universally adaptable in different cultural settings and contexts.

For constructive learning and teaching, this collaboration among the participants was required, although it demanded more time and effort. During the activities with children, the design expert mainly facilitated the programmes and interacted with other participants. She played distinctive roles: *planner, provider, motivator, accelerator,* and *reflective facilitator*. The whole programme was planned by collaborating with schoolteachers and providing children with spaces and materials, as well as setting up the educational context for the project. In addition to that, she provided opportunities for children to express their thoughts through design activities, and motivated children to participate in the projects through design toolkits and activities. She also encouraged the children in the development of their ideas and transferred her design knowledge and skills to them. The designer's role as facilitator emphasised interaction and reflectivity with other participants; afterwards, it was renamed '*reflective facilitator*'.

The structure provided practical guidance for audiences working with children in other projects. The approach also revealed a process of mutual learning between children and adults during the process. The children possessed opportunities to construct the materials-experience, and to learn new skills and knowledge through the design practices. Furthermore, the adult designer experienced a sufficient and

satisfactory working process with children through demonstrating the pedagogical approach in the actual practices. Teachers also experienced new teaching and learning approaches through collaboration with the design expert.

This research has been framed by *experimental design research*, rather than examining existing methods or providing hypotheses through testing. Through the experiments in the respective case studies, I applied the programme (child participation) as well as reflected on findings from the experiments and developed research questions. The research focused on seven- to twelve-year-old primary school children in Finland and South Korea. However, this research left room for the implementation of this approach with younger and older children, since partial cases in this research were conducted with both groups of children. With this reasoning in mind, I decided it would be best to purposely not mention any specific age group of children in the title of this dissertation. In addition, this research concentrated on the adult designers' roles and positions in Participatory Design (PD) practices based on an understanding of children's contributions to the design process.

In developing PD methods for working with children, earlier research has limited the focus to small sized groups in educational settings. To battle this tendency, this research has also been undertaken in an educational environment, mainly in primary schools, but conducted with larger groups, up to 25 children in one setting. There might be concern that by setting the research and practice in the educational environment, it would limit extending the practice to non-educational contexts and settings (e.g. professional design practice). School is part of the children's primary environment, thus enabling the designers and researchers to meet a more significant number of children in this familiar environment. To respond to this concern, selecting a school setting has improved both the validity and applicability of the research findings in terms of more extensive and valid implementation in professional design practice.

In addition, there have been few studies, which have focused on cross-cultural studies of children in the Interaction Design and Children (IDC)/Child-Computer Interaction (CCI) and PD communities. Hence, it would be beneficial for further studies to exploit a focus

on the similarities and differences of intercultural matters based on observations from this research. Children of different cultures were involved in this research: northern European and Korean. Cultural differences have impacted the PD recommendations. For instance, Korean children required more detailed instructions during the activities. However, the approaches and structure of activities have been almost identically implemented in both cultural settings. Importantly, the length and content of activities should be considered or modified depending on the schools' schedule and curricula. Moreover, children in groups and the group dynamics should be considered in PD sessions. Some children were more comfortable working alone; in contrast, many of the children thrived in a collaborative environment. Through different combinations of groups, group dynamics were positively exploited. Consequently, the relationships between adults and children, as well as among the children, were of more importance than any cultural differences.

## 7.2 Guidance in working with children

In the Preface, I listed the uncertainties experienced by the designers creating the artefacts for children. My personal motivation to find answers to these concerns encouraged me to dive into this doctoral research. Although I could not answer all the questions, I could minimise these uncertainties and better define the issues based on the findings and claims by conducting the practices with children.

Through these experimental design practices with children, I have expounded on the necessity of practical guidance when working with children. As mentioned earlier, the different data-collecting techniques and analysis methods have been applied as the working methods to the eight different cases. Each technique and method has distinctive characteristics and merits; therefore, it was relevant to consider the reasons for including and omitting some sources when I chose the data-collecting and analysis techniques. Based on the learning across the eight different cases, in **Table 19**, I have summarised the selection of data sources, collection methods, and analysis methods, and then the recommended use in the designing for and with children practices.

1. ***Diagram:*** This is a data source and data-collecting method. This is also a data analysis method from the initiative date collection and an effective way to holistically present interpretation methods of different collected data.
2. ***Memos:*** Memos are handy and a quick data sources/data-collecting method to jot down the process and findings during the cases. Different colours of sticky post-its are handy kits for taking memos.
3. ***Fieldnote:*** This is data source/data-collecting method for more detailed information, insights and findings during the events, but it requires a lengthy time to collect and analyse. This is recommended in *Social science for children*
4. ***Interview:*** Semi-structured interviews are recommended with adult participants before and after the activities, and more casual interviews are recommended with children during the activities.
5. ***Photos:*** Photos can be initial data sources/data-collecting method to capture prominent moments and outcomes from the activities.
6. ***Questionnaire:*** This could gather more detailed information and feedback from the participants; however, it requires writing skills and competence. These data-collecting methods are recommended for older children, i.e. at least over ten years old.
7. ***Sketch/drawing:*** Sketches/drawings by researchers can capture prominent moments and outcomes based on the researchers'intention and perspectives. In contrast, sketches/drawings by participants present their own ideas and thoughts.
8. ***Writing***: This is a less reliable data-collecting method as the quality of participants' writing will largely depend on their ability and capability of expressing themselves. Correction of the writing is not recommended to avoid misinterpretation during data analysis. The writing tasks shall be adjusted depending on the participants' age and writing competence.
9. ***Video:*** This is an effective data-collecting method to capture movement-focused research, but it requires much time and effort to analyse. Nevertheless, I recommend it as secondary materials since they present the overall environment and situation of the events.

Table 19. The different data source/data-collecting methods and data analysis methods recommended for use in different s of practice in designing *for* and *with* children.

| | DATA SOURCE/DATA COLLECTING METHODS OR DATA ANALYSIS METHODS | RECOMMENDED USE IN MODELS OF PRACTICE IN DESIGNING FOR AND WITH CHILDREN |
|---|---|---|
| 1. Diagram | Data source/Data collecting methods<br>& Data analysis method | Design for and with children<br>Social science for children<br>Tangible Ideation |
| 2. Memo | Data source/Data collecting methods | Design for and with children<br>Social science for children<br>Tangible Ideation |
| 3. Fieldnote | Data source/Data collecting methods | Social science for children |
| 4. Interview | Data source/Data collecting methods | Social science for children<br>Tangible Ideation |
| 5. Photo | Data source/Data collecting methods | Design for and with children<br>Social science for children<br>Tangible Ideation |
| 6. Questionnaire | Data source/Data collecting methods | Tangible Ideation |
| 7. Sketch / drawing | Data source/Data collecting methods | Design for and with children<br>Social science for children<br>Tangible Ideation |
| 8. Writing | Data source/Data collecting methods | Tangible Ideation |
| 9. Video | Data source/Data collecting methods<br>(In case, transcript and coding required for analysis) | Design for and with children<br>Social science for children<br>Tangible Ideation |

This has been in terms of respecting children, the content of inquiries, working methods, and relationship matters from the initial activity and product to the end of the process. I have listed below the significant findings gained through the practices of working with children from a designer's perspective. However, these should not be viewed as a determinate guide for other adults who are working for and with children, but rather as suggested tactics.

1. Ask children for permission to conduct the projects or research, even if you have already received consent from their

guardians. Adults often ignore this initiative despite children being the main participants, and not their guardians.

2. Respect children by listening attentively to their opinions and comments. Otherwise children might become unwilling to participate and actively perform in the projects. For instance, by listening to them, the risk of misinterpretation or unwanted outcomes is significantly reduced.
3. Deliver clear aims and the goals of activity before commencing any action.
4. Be flexible when planning and conducting projects with children. Each child possesses different competencies, skills, experiences, and intellectual abilities; therefore, the structure and tasks of the projects cannot be fully adapted to each one.
5. Be patient whilst waiting for children's answers and reactions.
6. Use scenarios and themes with which the children are familiar. Depending on the objectives of the projects or research, activities with children need to be planned within the boundaries of everyday contexts. These might engage children's competence, motivation and participation.
7. Explain holistically the whole process of the project in which the children are involved. Children cannot digest everything at once, but they are capable of independently navigating through the entire process once the broader context is understood.
8. Explain the process in detail step-by-step. Divide each stage into smaller steps by providing tasks to concentrate on exploring each inquiry.
9. Avoid a surfeit of new information or instruction all at once. Divide the procedure into phases based on children's previous experiences.
10. Combine telling, showing and doing to deliver new information or instruction to the children.
11. Remind children of their previous activities and validate their previous efforts.
12. Clearly define and allocate children's roles; enable them to experience different roles.
13. Balance child-initiative activities (free-play) and adult-directed activities (structured-play).

14. Allow children to speak and maintain their language, enable them to communicate with others, including adults and other children, through any medium with which they are comfortable.
15. Collect ideas on the same themes and tasks in different formats (e.g. words, pictures and models) and techniques (e.g. memos, drawings, photos and videos). These countercheck one another and explore more deeply children's ideas and opinions.
16. Applaud and encourage children to carry out their activities in the given tasks.
17. Do not just give orders to children.
18. Do not ignore children's difficulties and conflicts. Help them when they encounter any hindrances to developing their ideas.
19. Do not be demanding and constantly pressure children when they express their unwillingness and possible lack of motivation.
20. Reflect on the process and outcomes of the projects with children. These could be relevant resources to prevent similar mistakes and to develop the project for further studies.

## 7.3 Reflection and further implication

Mutual understanding and learning between the design practitioners (adult designers) and children were the focal purpose in this research. The practices working with children throughout three approaches provided both parties with opportunities within the contexts of designing for and with children. Children possessed opportunities to express their thoughts and perspectives through the provided materials and activities. Simultaneously, the practitioners could access the children's world and gain a thorough understanding of their voices and thoughts through outcomes and practices. The products referred to both outcomes created by children, and the kind of toolkits created and provided by the design practitioners during the activities. 'Materials' were the medium through which all of the developments for PD *for* and *with* children were proposed. These were the dialogue between 'products' and 'practices'. The practitioners' roles have been positioned before, during, and after the process, within which their key roles were to reflect the process and outcomes through practices.

This reflection was an indubitably relevant phase to accomplish the entire research as well as inform any forthcoming procedure and further studies.

There were various challenges in working with children, such as the enormous amount of time and effort demanded, the diversity of individual children, the imbalance of design activities, and the risk of misinterpretation or manipulation of outcomes by children. First, the design sessions required a considerable amount of time and effort; many design sessions were conducted over several weeks, and even short design activities needed several days to plan and facilitate. However, mutual learning benefited all the participants. Secondly, recruiting participants was also challenging, and children possessed different competencies and skills. For this reason, all design activities needed to be adaptable to average children in terms of their knowledge, experiences, skills, environment and security. However, these same aspects should be sufficiently flexible for them to succeed with children with special needs or other considerations. Herein, the adult designers should adopt adjustable positions and roles on these occasions. Finally, children should be allowed to present their outcomes, and the results from children need to be accurately interpreted and rationalised; otherwise, they might often be misinterpreted or described in such a way that they are of little or no use to the development process. Let us not forget that children's outcomes in whatever form always possess an inherent value.

This research has provided practical studies and guidance throughout the design practices. The applied techniques and approaches can be implemented in different professional design cases and educational contexts. Furthermore, the resources can guide other participatory and collaborative design projects. Children's creativity and enthusiasm are great resources for design, and help to overcome challenges, such as a lack of ideas and the frustration encountered when designers or design researchers design artefacts for children. The developed design outcomes (i.e. products, artefacts and toolkits) engage merits in both design and education: 1) as a medium to promise better communication and collaboration between children and adults, including designers, practitioners, researchers and educators; and 2) as generative objects to trigger children's participation and to extend further studies. I recommend these design research approaches and applications

when developing technologies for and with children, which is the primary domain in designing for and with children, as well as in a phenomenon-based curriculum, which is the current cutting-edge curriculum in primary education in Finland and South Korea.

To end this empirical research, I would like to emphasise the ethical stance of adults when they work for and with children. This responsible and responsive approach can allow us to reach a deep understanding of others, and enable us to learn to participate in design based on a mutual understanding and respect. Through this learning process, we can mould a better future. We improve and continuously reflect on the elements that constitute a 'good life', as well as on the ways we improve and balance people's living and working conditions. Adopting this notion to children, we, the adult designers and researchers, should consider our ethical responsibilities to improve and sustain children's well-being.

# Archive of Bang Jeon Lee – ABL

## Memo

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| ABL Memo 1, 2012 | The conversation with designer written in Jan. 2012 |
| ABL Memo 2, 2015 | A quotation from a lecture by Sampsa Hyysalo during User-Inspired Design course written on Oct. 2015 |
| ABL Memo 3, 2012 | Fieldnotes from Hut-building camp written in Jun. 2012 |
| ABL Memo 4, 2012 | Commentary from the participated children in the Case 1 written in Dec. 2012 |
| ABL Memo 5, 2013 | An example of one girl's writing a story, One day in the house (rewriting a pupil's story) written in May. 2013 |
| ABL Memo 6, 2013 | Commentary from the participated children in the Case 2 written on Jan. 2013 |
| ABL Memo 7, 2012 | The notes of episodes about children's interaction with materials from the first observational research written during Feb. to May. 2012 |

## Questionnaire

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| ABL Questionnaire 1, 2013 | The questionnaires about living place and creation with building blocks in Case *6. Build my city, Helsinki* created and answered in May. 2013 |

## Writing

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| ABL Writing 1, 2013 | An example of one girl's story, One day in the house written in May. 2013 |

## Diagram

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| ABL Diagram 1, 2016 | The research structure and process illustrated in Dec. 2016 |
| ABL Diagram 2, 2012 | The iterative process based on activities in different stage of design process illustrated in Sep. 2012 |
| ABL Diagram 3 2017 | The transition from designing for to designing with children results 'designing with and for children' as the scope and approach of this research illustrated in Jul. 2017 |
| ABL Diagram 4, 2017 | The iterative approach between design for and design with children adapted from Designerly ways of knowing by Cross illustrated in May. 2017 |
| ABL Diagram 5, 2017 | Time frame between Ethnography and PD illustrated in Dec. 2017 |
| ABL Diagram 6, 2016 | The position of building features and participants in the focused group (A. Building tree house with main activity spot), B. The group's hut, C. Another group's tree house, and D. Another group's hut) illustrated in May. 2017 |
| ABL Diagram 7, 2013 | Opportunities through ethnographic study in the contexts of with and for children illustrated in May. 2017 |
| ABL Diagram 8, 2017 | The material selections from the material image cards between the Finns and Korean pupils illustrated in Nov. 2013 |
| ABL Diagram 9, 2017 | The diagram of matrix from the Finn class illustrated in May. 2017 |
| ABL Diagram 10, 2017 | The material matrix by group 1 illustrated in May. 2017 |
| ABL Diagram 11, 2017 | The material matrix by group 3 illustrated in May. 2017 |

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| ABL Diagram 12, 2017 | The material matrix by group 5 illustrated in May. 2017 |
| ABL Diagram 13, 2017 | The material matrix by group 6 illustrated in May. 2017 |
| ABL Diagram 14, 2016 | Analysing elements of the five different models based on children's participation and a pedagogical approach in architecture design by Lozanovska and Xu (2013) illustrated in Dec. 2016 |
| ABL Diagram 15, 2016 | The primary structure of design activity with children in primary school curricular illustrated in Dec. 2016 |
| ABL Diagram 16, 2016 | The time allocation (percentage) among the five different cases in Dec. 2016 |
| ABL Diagram 17, 2016 | The structure in designing with children illustrated in Dec. 2016 |
| ABL Diagram 18, 2016 | The Double triangles depicting the iterative approach and designer's role in designing *for* and *with* children illustrated in Dec. 2016 |
| ABL Diagram 19, 2016 | Three adapted models to different design practices with children, *Designing with children approach* illustrated in Dec. 2016 |
| ABL Diagram 20, 2016 | Three adapted models to different design practices with children, *Social science approach* illustrated in Dec. 2016 |
| ABL Diagram 21, 2016 | Three adapted models to different design practices with children, *Pedagogical approach* illustrated in Dec. 2016 |
| ABL Diagram 22, 2016 | The iterative approach, positioning materials and designer's reflective roles in designing *for* and *with children* illustrated in Dec. 2016 |
| ABL Diagram 23, 2016 | The main contributions of this research illustrated in Dec. 2016 |

## Affinity diagram

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| ABL Affinity diagram 1, 2016 | Sticky-memos (during fieldwork) and rearrangement by process and initial keywords (after fieldwork) illustrated in Jun. 2012 |

## Table

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| ABL Table 3, 2016 | The different data collection from the cases illustrated in Dec. 2016 |
| ABL Table 4, 2012 | The different techniques revised as my own approach illustrated in Dec. 2016 |
| ABL Table 5, 2012 | The different activities with various groups of children in different locations illustrated in Sep. 2012 |
| ABL Table 6, 2012 | The contextual inquiry diagram 1 during design evaluation 'Play analysis of a four year-old boy' illustrated in Sep. 2012 |
| ABL Table 7, 2012 | The contextual inquiry diagram 2 during design evaluation 'Play patterns' illustrated in Sep. 2012 |
| ABL Table 8, 2012 | Designer and children learned from each activity at different stages in the development process illustrated in Sep. 2012 |
| ABL Table 9, 2016 | An overview of the five different cases in this pedagogical practice illustrated in Dec. 2016 |
| ABL Table 10, 2016 | The scopes and foci of the later five cases in Tangible ideation project illustrated in Dec. 2016 |
| ABL Table 11, 2016 | The structures and summaries of Lozanovska and Xu's (2013) pedagogical practice and two pilot studies adapted their pedagogical practice illustrated in Dec. 2016 |

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| ABL Table 12, 2016 | The different activities and tasks during the implementation sessions of Dream park in Helsinki and Build by city, Helsinki illustrated in Dec. 2016 |
| ABL Table 13, 2016 | The different activities and tasks during the implementation sessions of Build my city, Seoul and Build my space illustrated in Dec. 2016 |
| ABL Table 14, 2016 | New group arrangement & material condition illustrated in Dec. 2016 |
| ABL Table 15, 2016 | The ideas on Idea bubbles and idea selection by the pupils illustrated in Dec. 2016 |
| ABL Table 16, 2016 | Comparison word selections by group on the matrices illustrated in Dec. 2016 |
| ABL Table 17, 2016 | The time allocation (minutes) among the five different cases illustrated in Dec. 2016 |
| ABL Table 18, 2016 | The different roles of children and adults in the Lozanovska and Xu's (2013) models and the three practices in this research illustrated in Dec. 2016 |
| ABL Table 19, 2016 | The different data source/data collecting methods and data analysis methods recommended use in different models of practice in designing for and with children. |

## Transcript

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| ABL Transcript 1, 2012 | Keynote script of interesting moment from video recording wrote in Aug. 2012 (Appendix 2) |

## Images

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| ABL Image 1, 2012 | A model of furniture and space built by a child in *My furniture* project taken in Jan. 2009 |

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| ABL Image 2, 2012 | A model of horse made of recycled materials (toilet paper tube, cereal boxes, ice cream box and milk boxes) taken in Jun. 2012 |
| ABL Image 3, 2014 | The design outcomes applied to the post-activities with children taken in Feb. 2014 |
| ABL Image 4, 2014 | Drawings could capture children's experiences and ideas for further development after the post-activity with children taken in Feb. 2014 |
| ABL Image 5, 2012 | Holding tree branches taken in Jun. 2012 |
| ABL Image 6, 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |
| ABL Image 7, 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |
| ABL Image 8, 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |
| ABL Image 9, 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |
| ABL Image 10, 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |
| ABL Image 11, 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |
| ABL Image 12, 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |
| ABL Image 13, 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |
| ABL Image 14, 2012 | The different activities during *Hut-building* *e*vent taken in Jun. 2012 |
| ABL Image 15, 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |
| ABL Image 16 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |
| ABL Image 17, 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |

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| ABL Image 18, 2012 | The different activities during *Hut-building* event taken in Jun. 2012 |
| ABL Image 19, 2012 | The three non-participating children taken in Jun. 2012 |
| ABL Image 20, 2012 | Non-participated child in the collaborative task taken in Jun. 2012 |
| ABL Image 21, 2012 | A physical form of play taken in Jun. 2012 |
| ABL Image 22, 2012 | Creating toys and plays taken in Jun. 2012 |
| ABL Image 23, 2012 | Warning and caution signs created by the children taken in Jun. 2012 |
| ABL Image 24, 2016 | Material frottage taken in Sep. 2012 |
| ABL Image 25, 2016 | Material collages taken in Sep. 2012 |
| ABL Image 26, 2016 | Material image cards taken in Sep. 2012 |
| ABL Image 27, 2016 | Material palette boxes taken in Sep. 2012 |
| ABL Image 28, 2016 | Material palette sheets taken in Nov. 2013 |
| ABL Image 29, 2016 | Material matrices taken in May. 2013 |
| ABL Image 30, 2016 | Material sample kits taken in Nov. 2013 |
| ABL Image 31, 2016 | Material building blocks taken in May. 2013 |
| ABL Image 32, 2013 | The various activities during Case 6: Material blocks taken in May. 2013 |
| ABL Image 33, 2013 | The various activities during Case 6: inspecting the blocks & planning buildings taken in May. 2013 |
| ABL Image 34, 2013 | The various activities during Case 6: modelling with material blocks taken in May. 2013 |
| ABL Image 35, 2013 | The various activities during Case 6: drawing & writing taken in May. 2013 |
| ABL Image 36, 2013 | The various activities during Case 6: display buildings on the map taken in May. 2013 |
| ABL Image 37, 2013 | The various activities during Case 6: presentation taken in May. 2013. |
| ABL Image 38, 2013 | The final models from Case 5. Dream park taken in Jan. 2013 |

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| ABL Image 39, 2013 | The drawing of the *Tower of Pisa* taken in May. 2013. |
| ABL Image 40, 2014 | Displaying models on the map of Seoul taken in Nov. 2014 |
| ABL Image 41, 2012 | The Material Matrix from the second group in ARKKI taken in Dec. 2012 |
| ABL Image 42, 2013 | The *Idea bubbles* sheet taken in Jan. 2013 |
| ABL Image 43, 2012 | The student applying the experimented materials to build models taken in Dec. 2012 |
| ABL Image 44, 2013 | This project integrating various subjects (e.g. arts, design, architecture, mathematics, geography, literature and English) in the primary school curriculum taken in May. 2013 |
| ABL Image 45, 2012 | Building the structure of an organic building out of wooden veneer taken in Dec. 2012 |
| ABL Image 46, 2012 | Testing to build a polygon type of mock-up out of papers before beginning the real prototype taken in Dec. 2012 |
| ABL Image 47, 2013 | Pupil engaged in creating his output structure with mixed success taken in May. 2013 |
| ABL Image 48, 2013 | An example of pupil problem-solving taken in May. 2013 |
| ABL Image 49, 2012 | Entrance of camping site taken in Jun. 2012 |
| ABL Image 50, 2012 | Day trip taken in Jun. 2012 |
| ABL Image 51, 2012 | Placing and structuring tepee taken in Jun. 2012 |
| ABL Image 52, 2012 | Weaving reeds mates taken in Jun. 2012 |
| ABL Image 53, 2012 | Filling panels taken in Jun. 2012 |
| ABL Image 54, 2012 | Making playful elements taken in Jun. 2012 |
| ABL Image 55, 2012 | Playing with fire taken in Jun. 2012 |

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| ABL Image 56, 2012 | Making play equipment taken in Jun. 2012 |
| ABL Image 57, 2012 | Holding tree branches taken in Jun. 2012 |

(All the images are taken by the author.)

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# Appendix 1.
# Six relevant articles of The United Nation Convention on the Rights of Child (UNCRC)

## Article 1

For the purposes of the present Convention, a child means every human being below the age of 18 years unless under the law applicable to the child, majority is attained earlier.

## Article 12

1. States Parties shall assure to the child who is capable of forming his or her views the right to express those views freely in all matters affecting the child, the views of the child being given due weight in accordance with the age and maturity of the child.
2. For this purpose, the child shall in particular be provided the opportunity to be heard in any judicial and administrative proceedings affecting the child, either directly, or through a representative or an appropriate body, in a manner consistent with the procedural rules of national law.

## Article 13

1. The child shall have the right to freedom of expression; this right shall include freedom to seek, receive and impart information and ideas of all kinds, regardless of frontiers, either orally, in writing or in print, in the form of art, or through any other media of the child's choice.
2. The exercise of this right may be subject to certain restrictions, but these shall only be such as are provided by law and are necessary:
   (a) For respect of the rights or reputations of others; or

(b) For the protection of national security or of public order or of public health or morals.

## Article 28

1. States Parties recognize the right of the child to education, and with a view to achieving this right progressively and on the basis of equal opportunity, they shall, in particular:
   (a) Make primary education compulsory and available free to all;
   (b) Encourage the development of different forms of secondary education, including general and vocational education, make them available and accessible to every child, and take appropriate measures such as the introduction of free education and offering financial assistance in case of need;
   (c) Make higher education accessible to all on the basis of capacity by every appropriate means;
   (d) Make educational and vocational information and guidance available and accessible to all children;
   (e) Take measures to encourage regular attendance at schools and the reduction of drop-out rates.

2. States Parties shall take all appropriate measures to ensure that school discipline is administered in a manner consistent with the child's human dignity and in conformity with the present Convention.
3. States Parties shall promote and encourage international cooperation in matters relating to education, in particular with a view to contributing to the elimination of ignorance and illiteracy throughout the world and facilitating access to scientific and technical knowledge and modern teaching methods. In this regard, particular account shall be taken of the needs of developing countries.

## Article 29

1. States Parties agree that the education of the child shall be directed to:

(a) The development of the child's personality, talents and mental and physical abilities to their fullest potential;
(b) The development of respect for human rights and fundamental freedoms, and for the principles enshrined in the Charter of the United Nations;
(c) The development of respect for the child's parents, his or her cultural identity, language and values, for the national values of the country in which the child is living, the country from which he or she may originate, and for civilizations different from his or her;
(d) The preparation of the child for responsible life in a free society, in the spirit of understanding, peace, tolerance, equality of sexes, and friendship among all peoples, ethnic, national and religious groups and persons of indigenous origin;
(e) The development of respect for the natural environment.

2. No part of the present article or Article 28 shall be construed so as to interfere with the liberty of individuals and bodies to establish and direct educational institutions, subject always to the observance of the principle set forth in paragraph 1 of the present article and to the requirements that the education given in such institutions shall conform to such minimum standards as may be laid down by the State.

## Article 31

1. States Parties recognize the right of the child to rest and leisure, to engage in play and recreational activities appropriate to the age of the child and to participate freely in cultural life and the arts.
2. States Parties shall respect and promote the right of the child to participate fully in cultural and artistic life and shall encourage the provision of appropriate and equal opportunities for cultural, artistic, recreational and leisure activity (The UN Convention on the Right of Child).

# Appendix 2.
# The contextual inquiry diagrams

Table 6: The contextual inquiry diagram 1 during design evaluation 'Play analysis of a four year-old boy' (ABL Table 6, 2012).

| DURATION | ACTIVITIES | REACTION | INTERACTION | PLAY PATTERNS | DESIGN IDEAS |
|---|---|---|---|---|---|
| 39;06 | Moving | | | 1. Moving | |
| | Balancing | | | 4. Standing, rocking and balancing | |
| | Jumping and stepping | | | 10. Stepping and jumping | |
| | Lying down and making sound with foot | | | 11. Lying down | |
| | Dragging | | | 1. Moving | |
| | Lying down and making sound with foot | | | 11. Lying down | Connecting with sensitivity play |
| | Riding sledge with dad | Laughing | With dad | 9. Pulling and riding | Considering weight of artefacts |
| | Lifting by dad and sibling | Laughing | With dad and sister | 2. Carrying and lifting | Connecting with sensitivity play |
| | Break | | | | Interactive play |
| | Siting and shaking | | | 3. Sitting and rocking | Interactive play |
| | Entering hut | | | 7. Playing in hut | |
| | Sitting and shaking | | | 3. Sitting and rocking | |
| | Building hut with dad | | With dad | 5. Stacking and building | |
| | Entering hut | | | 7. Playing in hut | Closed space |
| | Entering hut with sister | | With sister | 7. Playing in hut | |
| | Asking dad to cover hut | Laughing | With dad | 7. Playing in hut | |
| | Coming in and out from tunnels | | With dad | 8. Playing in tunnels | |
| | Coming out through other exit | | With dad | 8. Playing in tunnels | |
| | Coming in and out from tunnels | | With dad | 8. Playing in tunnels | |
| | Coming out through other exit | | With dad | 8. Playing in tunnels | |
| | Destroying tunnels | | With dad | 6. Destroying | |
| | Rebuilding tunnels | | With dad | 5. Stacking and building | |
| | Moving and shaking with dad | | With dad | 1. Moving | |
| | Arguing with sister | Angry | With sister | 15. Etc. | Frustration during play |
| | Shaking | | | 4. Standing, rocking and balancing | |
| | Arranging pieces | | | 1. Moving | |
| | Pulling by dad | | With dad | 9. Pulling and riding | Sledge design |

Table 7: The contextual inquiry diagram 2 during design evaluation 'Play patterns (Group1: 13 children, Play duration: 01:25:00)' (ABL Table 7, 2012).

| NO. | PLAY PATTERNS | FREQUENCY |
|---|---|---|
| 1 | Moving | 9 |
| 2 | Carry and lifting | 9 |
| 3 | Seating and rocking | 14 |
| 4 | Standing, rocking and balancing | 20 |
| 5 | Stacking and building | 18 |
| 6 | Destroying | 2 |
| 7 | Playing in a hut | 20 |
| 8 | Playing in tunnels | 8 |
| 9 | Pulling and riding | 7 |
| 10 | Stepping and jumping | 6 |
| 11 | Lying down | 13 |
| 12 | Turning | 2 |
| 13 | Playing hide and seek | 5 |
| 14 | Sitting-up | 0 |
| 15 | Other activities | 18 |

# Appendix 3.
# Data-collecting & Categorising Hut-building activities

## Initial findings categorised by different activities (ABL Image 6-57, 2012)

| SCENES | | DESCRIPTION |
|---|---|---|
| Entrance of camping site |  | Adult instructor picked up children at the entrance and guided them to the camping site. |
| Picking up timber |  | Children collected appropriate timber and carried them in pairs from the entrance of the site. |
| Day trip |  | Children played hiding & finding treasures. A half group went to trip and hide treasures. They made maps for another half group to find treasures later. The other group had maps<br>They go trip to find treasures. Children received rewards and shared them with peers after the excursion.t |
| Placing and structuring tepee |  | We collected three-birch timber thick enough for the main structure of tepee. We tied the three timber with s rope, then each branch needed gaps from each other. We pulled up the main structure with a thick rope connected to one spot of three timber. Later we opened the timber and made triangle shape of base. We added two or three birth timber more on each side of the structure. Finally, we rearranged the gaps between each timber. |

| SCENES | | DESCRIPTION |
|---|---|---|
| Measuring and cutting timber |  | Children measured and cut birth timber to make cross vertical supports of tepees. |
| Tying with knots |  | With vertical and horizontal structures, we needed to tidy them as square knots. This work required strength to tidy. |
| Building frames for 2nd floors |  | Horizontal branches needed to be replaced 1metre apart from ground. |
| Building frames for 3rd floors |  | Children made third floors after they finished 2nd floors. Previous works had to be done and it should be stable enough to continue building. |
| Building stairs |  | Children built stairs to climb up third floors. |

| SCENES | | DESCRIPTION |
|---|---|---|
| Weaving reeds mates |  | Picking up reeds from see shore<br>Preparing 8 thin wooden sticks to make weaving frame<br>Weaving reeds mates |
| Supporting branches |  | For building second and third floors, we made horizontal supporting branches. |
| Filling panels |  | We put wooden panels a top of the supporting branches and left space for climbing up. |
| Tunnels |  | We sharpened strong weeds for base structure of tunnels and pulled the sharpen weeds to the ground. Afterwards, we tied ends of weeds in the middle of tunnels and weaved with weeds to build tunnels. Finally, we connected the tunnel with other huts. |
| Covering |  | We covered tepees with various materials: wooden panels, reed mates, and fabrics. |

| SCENES | | DESCRIPTION |
|---|---|---|
| Using tools |  | Most of children were very enthusiastic to using tools: a saw, a hammer, a knife, a claw, nails. Teachers had to make turns to all children's opportunities to using tools. Children were not afraid to use actual tools, but teachers or assistants had to be with them whilst they were using tools. |
| Making playful elements |  | Children liked swings or similar objects as swings. |
| Playing with fire |  | Children were enthusiastic to play with fire. During free play or break time, they wanted to make more fire. A several time, we grilled sausages on the fire. For grilling, all were needed wooden sticks. |
| Making play equipment |  | Children liked to make their play equipment such as weapons: archery, arrows, gun, etc. |
| Tying |  | Collaboration were required to build. |

| SCENES | | DESCRIPTION |
|---|---|---|
| Caution sign |  | Children made caution signs with wooden panels and sticks.<br>“Don’t step it up.”<br>“Don’t hurt.” |

# Appendix 4.
# Transcript of Hut-building activities

## Keynote script of interesting moment from video recording (ABL Transcript 1, 2012)

| | |
|---|---|
| Title | Collaboration_ holding tree branches |
| Time | 27. 06. 2012 |
| Period | 01:51:27 |
| Description | Children and an adult instructor are building a tree house.<br>Hannah is tying ropes.<br>Hanna is seating on top of the tree branches.<br>Andrei is holding tree branches and talking with an instructor.<br>Instructor is pulling and tying rope.<br>  |

| | |
|---|---|
| [00:00:00.15] | Andrei: Then, keep it other one.<br>(Hannah is tying a rope iteratively.) |
| [00:00:08.00] | Instructor: This is not supposed to hold.<br>(Nea is playing on rope behind the instructor and instructor is pulling rope.) |
| [00:00:16.26] | Instructor: Ok, now. Lets stay it higher.<br>(Instructor is pulling ropes several times.) |
| [00:00:21.19] | Instructor: Now, someone takes distant and looks that is straight. Go, go, go, go, there.<br>(Nea is following instruction and going to see the line of tree branches.)<br>(Instructor is pulling ropes more.) |
| [00:00:31.00] | Instructor: Julia! (She is watching backside to find her.) Can you see it straight? (Use her hands to show straight line) Is it same line as that one? (moving tree branches to higher position)<br>Higher, higher, higher.<br>(Andrei is holding the tree branches with this head.)<br>(Hanna is holding main tree and watching down the tree branches.) |
| [00:00:41.25] | Andrei: Oh..... |
| [00:00:40.06] | Instructor: A bit bit lower, a bit lower, like that. Keep it there. Keep it just there. Keep it there.<br>(Hannah is still tying rope on the opposite site of tree house.)<br>(Andrei is holding a tree branch hardly.) |
| [00:00:49.28] | Andrei: I can't. It is too heavy.<br>(An instructor starts to tidy rope.) |
| [00:00:52.18] | Andrei: U..hmmmm. hmmmm.....(Andrei makes strange noise.) |
| [00:00:52.00] | Instructor: Yes, you can. |
| [00:00:55.03] | t Instructor: Someone comes and help Andrei. Helen, come and help Andrei.<br>(Andrei makes strange noise.) |
| [00:00:58.18] | Instructor: You can keep it.<br>(Tree branches which are hold by Andrei are falling down.<br>Helen and Nea come to help Andrei. ) |
| [00:01:01.22] | Instructor: Come and help Andrei. |
| [00:01:01.10] | Andrei: Excuse me. Hold these sticks.<br>(Helen is grab the tree branches which Andrei was pointing out.) |
| [00:01:05.09] | Instructor: Helen, don't (...) the tree.<br>Higher, higher, higher. |
| [00:01:10.19] | Andrei: It's still heavy. |
| [00:01:11.03] | Instructor: Isn't it line now.<br>A bit higher more. Lower, lower. |
| [00:01:16.05] | Andrei: It is still heavy. |
| [00:01:16.24] | Andrei: Ah, ah...<br>(a bit of screaming of Andrei.<br>He is holding the tree branches with his head.) |
| [00:01:18.16] | Instructor: Keep it there. Don't move.<br>(Andrei take off his hands from tree branches) |
| [00:01:23.00] | Andrei. You are doing that.<br>(Andrei takes off his hands from the tree branches.) |
| [00:01:24.07] | Instructor: No, no, Andrei, Andrei, Keep it.<br>(Instructor is tying rope around of tree.<br>Andrei is holding the branches again.) |

| | |
|---|---|
| [00:01:26.10] | Instructor: Otherwise, you are doing this now.<br>You are doing it until tying up.<br>You can choose.<br>(Andrei takes off his hands again.) |
| [00:01:31.10] | Instructor: Andrei, keep it.<br>(Andrei takes off his hands again.) |
| [00:01:38.29] | Instructor: Hey, hey, hey, keep it.<br>(Andrei is holding the branches with one hand.) |
| [00:01:42.08] | Someone: Yeh, keep it.<br>(Instructor is pulling and tying rope) |

# Appendix 5. Figures & Tables

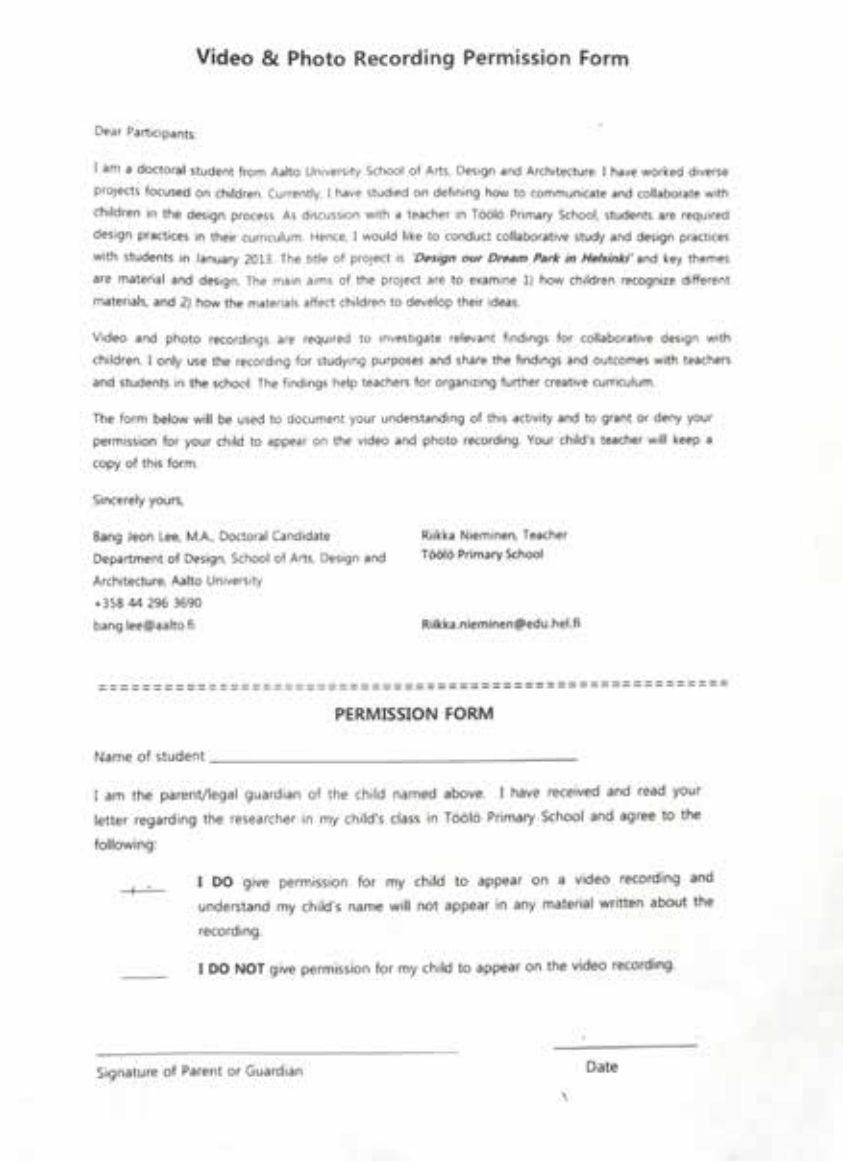
## Figure



## Table

# Appendix 6. Consent form

## The consent form of Case 5 *Dream park*



**Video & Photo Recording Permission Form**

Dear Participants

I am a doctoral student from Aalto University School of Arts, Design and Architecture. I have worked diverse projects focused on children. Currently, I have studied on defining how to communicate and collaborate with children in the design process. As discussion with a teacher in Töölö Primary School, students are required design practices in their curriculum. Hence, I would like to conduct collaborative study and design practices with students in January 2013. The title of project is '***Design our Dream Park in Helsinki***' and key themes are material and design. The main aims of the project are to examine 1) how children recognize different materials, and 2) how the materials affect children to develop their ideas.

Video and photo recordings are required to investigate relevant findings for collaborative design with children. I only use the recording for studying purposes and share the findings and outcomes with teachers and students in the school. The findings help teachers for organizing further creative curriculum.

The form below will be used to document your understanding of this activity and to grant or deny your permission for your child to appear on the video and photo recording. Your child's teacher will keep a copy of this form.

Sincerely yours,

Bang Jeon Lee, M.A., Doctoral Candidate
Department of Design, School of Arts, Design and Architecture, Aalto University
+358 44 296 3690
bang.lee@aalto.fi

Riikka Nieminen, Teacher
Töölö Primary School
Riikka.nieminen@edu.hel.fi

**PERMISSION FORM**

Name of student _____

I am the parent/legal guardian of the child named above. I have received and read your letter regarding the researcher in my child's class in Töölö Primary School and agree to the following:

_____ **I DO** give permission for my child to appear on a video recording and understand my child's name will not appear in any material written about the recording.

_____ **I DO NOT** give permission for my child to appear on the video recording.

_____ _____
Signature of Parent or Guardian Date

Figure 13. The consent form of Case 5 *Dream park*

Note: This consent form was valid for Case 6 *Build my city, Helsinki* since the same group of pupils participated in this case.

# The consent form of Case 7 *Build my city, Seoul*

**촬영 동의서**

안녕하세요.

저는 핀란드 헬싱키 알토예술대학의 박사 과정 연구원 이방전입니다. 현재 '어린이와 함께하는 어린이를 위한 디자인'이란 주제로 박사 논문 연구 중이며, 본 연구의 일환으로 어린이들의 디자인 교육 및 체험을 위한 워크샵을 핀란드와 한국에서 진행하고 있습니다. 핀란드와 한국 두 나라 어린이들을 대상으로 사례 비교 연구 진행 중이며, 2013 년 10 월 31 일 서울연희초등학교에서의 5 학년 2 반 학생들과 디자인 워크샵을 진행하게 되었습니다. 이번에 제안되는 워크샵은 오감을 활용한 주변의 소재를 체험하는 활동으로 디자인을 통한 창의적 통합 교육을 목표로 하고 있습니다. 본 워크샵은 핀란드 헬싱키 몰로 초등학교 및 아르끼 어린이 건축학교에서 선행되었고 담임 선생님을 포함한 교육 및 디자인, 건축 관련 전문가의 긍정적 호응과 자문을 받았습니다. 또한 워크샵에 활용된 교구 및 활동은 핀란드 아르끼 어린이 건축학교의 선생님들 및 학생들과 함께 개발되었으며 이후 보완되어 이번 워크샵에 활용할 예정입니다. 워크샵의 과정 및 결과물을 사진과 영상으로 기록하기 위하여 촬영 동의서를 요청드립니다. 결과물은 박사 논문 연구의 목적으로만 활용되며 서울연희초등학교 선생님 및 학생들과 공유하도록 하겠습니다.

이방전 배상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5 학년 2 반 담임
서울연희초등학교


========== **촬영 동의서** ==========

학생 이름:
_____

본인은 위 학생의 보호자로 수업 중 촬영을 동의합니다.

_____

날짜 보호자 사인

Figure 14. The consent form of Case 7 *Build my city, Seoul.*

Note: This consent form was valid for Case 5 *Dream park* since the same group of pupils participated in this case.

# The consent form of Case 8 *Build my space* project

**촬영 동의서**

안녕하세요.

저는 핀란드 헬싱키 알토예술대학의 박사 과정 연구원 이방전입니다. 현재 '어린이와 함께하는 어린이를 위한 디자인'이란 주제로 박사 논문 연구 중이며, 본 연구의 일환으로 어린이들의 디자인 교육 및 체험을 위한 워크샵을 핀란드와 한국에서 진행하고 있습니다. 핀란드와 한국 두 나라 어린이들을 대상으로 사례 비교 연구 진행 중이며, 2014 년 10 월 21 일과 22 일 양일 청주교동초등학교 학생들과 디자인 워크샵을 진행하게 되었습니다. 이번에 제안되는 워크샵은 오감을 활용한 주변의 소재를 체험하는 활동으로 디자인을 통한 창의적 통합 교육을 목표로 하고 있습니다. 본 워크샵은 핀란드 헬싱키 몰로 초등학교 및 아르끼 어린이 건축학교에서 선행되었고 담임 선생님을 포함한 교육 및 디자인, 건축 관련 전문가의 긍정적 호응과 자문을 받았습니다. 또한 워크샵에 활용된 교구 및 활동은 핀란드 아르끼 어린이 건축학교의 선생님들 및 학생들과 함께 개발되었으며 이후 보완되어 이번 워크샵에 활용할 예정입니다. 워크샵의 과정 및 결과물을 사진과 영상으로 기록하기 위하여 촬영 동의서를 요청드립니다. 결과물은 박사 논문 연구의 목적으로만 활용되며 청주교동초등학교 선생님 및 학생들과 공유하도록 하겠습니다.

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========== **촬영 동의서** ==========

학생 이름:
_____

본인은 위 학생의 보호자로 수업 중 촬영을 동의합니다.

_____

날짜 보호자 사인

Figure 15. The consent form of Case 8 *Build my space*

Note: This consent form followed the contnes of Case 5 *Dream park*; therefore, the English translated form has excluded.

# Appendix 7. Biography

## Bang Jeon Lee's Curriculum Vitae

| CONTACT INFORMATION | |
|---|---|
| Address | Karviaiskaati 14 E 10, VANTAA, FINLAND |
| Mobile | +358 44 296 3690 |
| E-mail | bang.lee@aalto.fi |
| RESEARCH INTERESTS | |
| Child-Centred Design, Participatory Design, Co-design, Human-Centred Research, Furniture Design, Product Design, Design Ethnography, Design Game, Product Prototyping, Focus Group Study, Usability Testing | |
| EDUCATION AND DEGREES AWARDED | |
| Jan. 2012 – Aug. 2019 (Absence Jul. 2013 – Jul. 2015) | Doctor of Arts, Department of Design, School of Arts, Design and Architecture, Aalto University, Finland (Dissertation titled, Tangible Ideation: How to design for and with children?) |
| Aug. 2007 – May. 2009 | University of Art and Design Helsinki, Finland<br>Master of Arts, Master's Degree Programmes in Furniture Design, School of Design |
| Mar. 2002 – Feb. 2007 | Hong-Ik University, Korea<br>Bachelor of Fine Arts, Woodworking & Furniture Design, Fine Arts<br>Bachelor of Fine Arts, Industrial Design, Fine Arts |
| WORK EXPERIENCES | |
| May. 2019 – current<br>Project Manager | Graphic Concrete Ltd., Finland<br>• Managing international projects, consultation, communication and marketing focusing on European and Asian market |
| April. 2019 – August. 2019<br>Doctoral researcher | Department of Design, School of Arts, Design and Architecture, Aalto University, Finland<br>• Research and teaching |
| Oct. 2017 – present<br>Senior Manager of International Projects | World of TRE Oy Ltd., Finland<br>• Nordic Design and lifestyle retail media and platform business setting up in Korea and Japan<br>• Organising pop-up stores and events in Korea and Japan<br>• Communication and Marketing of retail business focusing on Korea and Japan |
| Sep. 2016 – Sep. 2017<br>Coordinator | Messukeskus, Expo and Convention Centre, The Finnish Fair Corporation, Finland<br>• Coordinating a collaboration project between Finland and South Korea, United Stories project, Habitare 2017 |
| May. 2016 – May. 2017<br>Doctoral researcher | Department of Design, School of Arts, Design and Architecture, Aalto University, Finland<br>• Conducting doctoral research, advising and tutoring Master students |

| | |
|---|---|
| Jan. 2009 – Dec. 2017<br>Educator | Korealainen kieliyhdistys, Finland<br>• Teaching students (1-18yrs) on Korean language<br>• Organising art and design activities |
| Mar. 2013 - Jun. 2013<br>Doctoral researcher | Living places Research Group, Aalto University, Finland<br>• Conducting doctoral research |
| Jun. 2009 - Jun. 2011<br>Director | Research and Design institute, Chungwoo Funstation Ltd., Seoul, Korea<br>• Leading and managing a team (8-10 employees)<br>• Responsible for product development and research,<br>• Responsible for cost management, recruitment as well as negotiating with foreign partner company on contracts |
| Nov. 2005 - Jun. 2007<br>Designer | Development department, Edutain Ltd., Seoul, Korea<br>• Developing new products (Furniture and playgrounds for children) |
| Mar. 2006 - Dec. 2006<br>Teacher | Attached Girls' Senior High School College of Education, Hong-Ik University, Seoul, Korea<br>• Teaching art and design to high school students |

TEACHING EXPERIENCES IN UNIVERSITY

Master Course Tutorial

| | |
|---|---|
| Aug. 2016 – Sep. 2019 | Tutor, Personal Project course (MUO-E0006 & MUO-E0007, 8 ETCS), Core course for MA Programme in Department of Design, Aalto University (Teacher in charge: Heidi Paavilainen) |
| Sep. 2008 | Tutor, Introduction to Joint Master Studies (5 ETCS), Core course for MA Programme in Department of Design, University of Art and Design Helsinki (Teacher in charge: Toni Kauppila) |

Master's Thesis Advice

| | |
|---|---|
| Jan. 2018 – Dec. 2019 | Chin Chin Wong, Master's Thesis of Creative Sustainability, Riddle of the Spirit: Promoting sustainability through playful learning design in Finnish education, Thesis grade received 5 out of 5. |
| May. 2017 – Dec. 2019 | Gyönyi Fekete, Master's Thesis of Collaborative and Industrial Design, P(L)AT ATTENTION!: Involving children with deficit hyperactivity disorder into designing playful experiences, Thesis grade received 4 out of 5. |
| Sep. 2016 – Jun. 2017 | Gabriela Rubini, Master's Thesis of Collaborative and Industrial Design, Baby steps: introducing co-design in public space interventions with early childhood and vulnerable communities in Uruguay, Thesis grade received 3 out of 5. |

| | |
|---|---|
| Oct. 2015 - Apr. 2016 | Kaija Aalto, Master's Thesis of Product and Spatial Design, Hiput: Oppimisympäristökalusteen sunnittelu yhteissuunnittelun keinoin, Thesis grade received 4 out of 5. |

Master's Thesis Evaluation

| | |
|---|---|
| Jun. 2016 | Jinping Liu, Master Thesis of Collaborative and Industrial Design, Learning in Role Playing: An Ethnographic Study on Chinese Children Towards a Novel Educational Game Model |

## PUBLICATIONS

Peer-reviewed conference proceedings

- Lee, B. (2017). Tangible opportunities: Designing material studies and toolkits for school-aged children. International Conference 2017 of the Design Research Society Special Interest Group on Experiential Knowledge (EKSIG), Delft University of Technology, Het Nieuwe Instituut, Rotterdam, The Netherland 19-20 Jun. ISBN: 978-87-90775-90-2, pp. 168-182.

- Lee, B. (2016). Build together! - Observational study on outdoor activities engaging children in design. Proceeding in the Cumulus Association Biannual International Conference at Hong Kong Design Institute, Hong Kong, China. 21-24 Nov. ISBN 978-952-60-0081-7, pp. 485-492.

- Liu, P. & Lee, B. (2016). Learning n Role Playing: An Ethnographic Study on Chinese Children Towards a Novel Educational Game Model. Proceeding in the Cumulus Association Biannual International Conference at Hong Kong Design Institute, Hong Kong, China, 21-24 Nov. ISBN 978-952-60-0081-7, pp.534-536.

- Lee, B. (2016). Tangible Ideation: Developing material study approaches and toolkits with children to enhancing design education for children. Proceeding in Cumulus Association Biannual International Conference at Nottingham Trent University, UK, 27 April-1 May. ISBN 978-0-9928878-1-0, pp. 302-308.

Seminar publication

- Lee, B 2009, 'Furniture Design in the Guidance of Children', Creating the Future Ideas on Architecture and Design Education, pp.50-53, Arkki, Helsinki.

Thesis

-Lee, B 2009, Dal: experimental user-inspired design project for children - Furniture for children to motivate indoor activities, MA thesis, Taideteollinen korkeakoulu, Helsinki.

## OTHER ACADEMIC EXPERIENCES

Reviewing conference proceedings

- Reviewing paper submission in the Cumulus Association Biannual International Conference at Conférence des Écoles supérieures d'Arts appliqués de Paris, 11-13 Arpil 2018.
- Reviewing paper submission in the Cumulus Association Biannual International Conference at Kolding Institute, Denmark, 27-30 May 2017.

Invited academic presentation

- Learning from Designing for and with children. Research with and for children: Place, Pedagogy and Play conference in Edinburgh Collage of Art, University of Edinburgh, Edinburgh, 8-9 May 2017.

| RESEARCH FUNDING & GRANTS | |
|---|---|
| Mar. 2017 | Aalto University School of Arts, Design and Architecture, Finland<br>900 €, Department of Design Express Grant |
| Nov. 2016 | Aalto University School of Arts, Design and Architecture, Finland<br>1500 €, Department of Design Express Grant |
| Jan. 2015 - Dec. 2015 | Arts Promotion Centre Finland, Finland<br>1650 €, Regional project grant for children's culture |
| Jan. 2014 - Dec. 2014 | Arts Promotion Centre Finland, Finland<br>7000 €, Project grant |
| Oct. 2013 | Aalto University School of Arts, Design and Architecture, Finland<br>1000 €, Encouragement scholarship |
| Jan. 2013 - Dec. 2013 | Arts Promotion Centre Finland, Finland<br>3280 €, Regional grant for a working group |
| Sep. 2012 - Feb. 2013 | CIMO Centre for International Mobility, Finland<br>9000 €, Finnish Government Scholarship Pool |
| Jun. 2012 | Aalto University School of Arts, Design and Architecture, Finland<br>300 €, ARTS Scholarship |
| Sep. 2012 | Aalto University School of Arts, Design and Architecture, Finland<br>600 €, ARTS Scholarship |
| PROJECTS | |
| Jan. 2016 | Rakenna kaupunki design workshop, Design Museo, Helsinki, Finland<br>Invited to organise and facilitate the workshop for family and children |
| Mar. 2016 | Jeju x Posio: Cultural exchange project between Korea and Finland, Posio, Finland<br>Directing the artistic and cultural events |
| Nov. 2014 | Build my space project, Kyodong Elementary School, Korea<br>Organising and facilitating the workshop for the 2nd grade pupils |
| Nov. 2014 | Build my City, Seoul project, Seoul Yeonhui Elementary School, Korea<br>Organising and facilitating the workshop for the 5th grade pupils |
| May. 2013 | Build my City, Helsinki project, Töölö Primary School, Helsinki, Finland<br>Organising and facilitating the workshop for the 5th grade pupils |
| Jan. 2013 | Dream our Park in Helsinki project, Töölö Primary School, Helsinki, Finland<br>Organising and facilitating the workshop for the 5th grade pupils |
| Sep. – Dec. 2012 | Organic Architecture project, ARKKI (Arkkitetuurikoulu Helsinki), Finland<br>Organising and facilitating the workshop for children (13-19yrs) |

| | |
|---|---|
| Sep. – Dec. 2012 | Zoo project, ARKKI (Arkkitetuurikoulu Helsinki), Finland<br>Organising and facilitating the workshop for children (7-12yrs) |
| Agu. 2012 - Sep. 2012 | Månen Design workshop, Barnas Kultural Hus in Bergen, Norway<br>Organising and facilitating the pop-up design workshop for children and family |
| Dec. 2008 - Jan. 2009 | My furniture & playgrounds projects, Arkkitetuurikoulu, Helsinki, Finland<br>Organising and facilitating Design workshop with children |

ARTISTIC ACTIVITIES

| | |
|---|---|
| Sep. 2013 | Soul in Helsinki+: Group Exhibition at Node Gallery, Helsinki, Finland<br>Participating the group exhibition and organising participatory exhibition Build my City |
| May. 2013 | Soul in Helsinki: Group Exhibition at Ava Gallery, Helsinki, Finland<br>Participating the group exhibition |
| Mar. 2012 | TOUCH WOOD!: Works by the Wood Studio at Alvar Aalto Museum, Jyväskylä, Finland<br>Participating the group exhibition |
| May. 2009 | Leukku: Exhibition, Inari, Finland<br>Assisting the project and exhibition |
| May. 2009 | Master of Art Exhibition at the University of Art and Design Helsinki, Finland<br>Participating the graduation work exhibition |
| May. 2009 | Selected final works Exhibition at Norsu Gallery, Helsinki, Finland<br>Participating the selected work exhibition |
| Feb. 2009 | Compact Kitchen: Exhibition at Alvar Aalto Museum, Jyväskylä, Finland<br>Participating the project and the group exhibition |

SKILLS

Documentation, Visualization and Computer modelling

MS office (Word, Excel, Power Point), Adobe (Illustrator, Photoshop, InDesign, Premier), 3ds-Max, Auto Cad

POSITIONS OF TRUST IN SOCIETY AND OTHER SOCIETAL MERITS

| | |
|---|---|
| Jul. 2017 - present | Writer, Crossee Working Group, Korea |
| Jan. 2017 – present | Affiliate member, Encore Research Group, Department of Design, School of Arts, Design and Architecture, Aalto University, Finland |
| Mar. 2015 – present | Designer, Kanssa Arts and Cultural Organisation, Korea |
| Jan. 2012 – Jun. 2013 | Member, Living Places Research Group, Department of Design, Aalto University School of Arts, Design and Architecture, Finland |
| Sep. 2012 – May. 2013 | Vice president, Korean Student Association in Finland (KOSAFI) |
| May. 2012 – present | Co-founder and active member, TaideKo Korean Arts and Design Association in Finland ry |

# Appendix 7. Portfolio

## DAL : An user-inspired design project with children

2012 - 2014
Product development 'DAL'
7mm laminated plywood, 10mm foam, fabric, zipper

2009 Master of Arts Diploma work
Master of Arts Programmes in Furniture Design 2007 - 2009
University of Art and Design Helsinki, Finland

## Rakenna Kaupunki

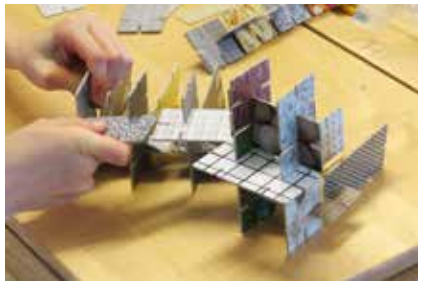
Design workshop for family and children
Jan. 2016 Design museum, Helsinki, Finland
Participants: approx. 50 children and families
Activities: Building, Drawing and Display on the map

## Build my city, Helsinki

Design workshop
May. 2013 at Töölö Primary School
Participants: 22 children (11-12y)
Activities: Discussion, Building, Drawing, Display on the map, Writing, Presentation
Applied tool kits: Material block Set A & B

Material building blocks Set A & B

Searching & Planning



Model-making with blocks

Model of a new building

Drawing of a new building

Displaying on a map

## Dream park

Design workshop
January 2013 at Töölö Primary School
Participants: 24 children (11-12y)
Activities: Discussion, Material study, Planning in a group, Building, Presentation
Applied tool kits: Material image cards, collage, matrix

Material image cards

Material image card games

Material palette

Material collage & matrix

Group ideation & Idea bubbles

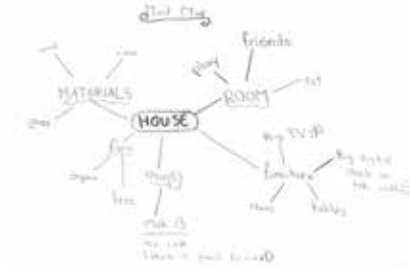
Collaborative model-making

## Organic Architecture

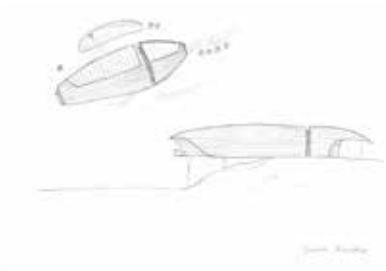
Design project
October - December 2012 at Arkki
Participants: 9 children (13-19y)
Activities: Discussion, Planning, Building, Drawing, Photoshooting, Presentation
Applied tool kits: Material collage, matrix

Material collage

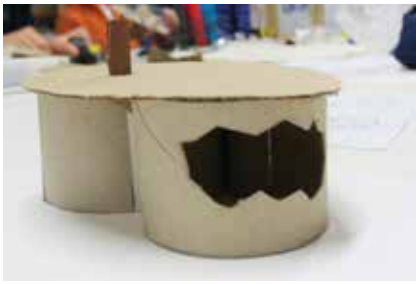
Material matrix




Planning with mind map



Planning with drawing



Sketch mock-up & Model-making

Final drawing & Presentation

## Oh my Zoo

Design project
September - December 2012 at Arkki
Participants: 26 children (7-9y, 10-12y)
Activities: Discussion, Planning, Building, Drawing, Profiling, Presentation
Applied tool kits: Material frottage, collage, matrix

Material frottage

Experiencing materials


Material collage

Material matrix

Planning & Drawing

Model-making & Presentation

# Acknowledgement

As a designer, researcher, educator and mother, this entire doctorate journey has enriched my personal growth. From the personal interest though experiences between studying and working in both academia and industry, I have constantly been concentrating on design and research concerning children. These experiences have strengthened my professional qualifications, designerly skills, as well as personal confidence, and finally led me into this doctoral research. During this journey, I have received much support from many organisations and people.

First of all, I appreciate the Department of Design, School of Arts, Design and Architecture at Aalto University for providing me with a warm and inspiring venue to conduct my doctoral research. Especially thanks to **Turkka Keinonen** who welcomed me into this design research community. I originally belonged to a very practical design side; therefore, it was rather challenging to step into this research community at the beginning. Whilst I was developing my claim, he referred to Cross' triangles at our second meeting in early 2012, which inspired me and accelerated the framing of the whole research approach and process. I have also received much warm support from my doctoral study's supervising professor, **Sampsa Hyysalo**, and my two advisors, **Sari Dhima** and **Jack Whalen**. I would like to say thank you to them for all their guidance and for encouraging me all the time. I also appreciate **Maarit Mäkelä**, **Ramia Maze**, **Oscar Person**, **Miikka Lehtonen** and **Teemu Leinonen** for their critical and useful comments on my research during the DoD Summer School, the DoD Winter Schools, DoD Research Seminars and other research related conversation. In addition, I would like to thank **Peter McGrory** who first suggested continuing to doctoral studies when I was a MA student.

The pre-examination phase yielded critical and insightful comments from these two great scholars, Prof. **Ole Sejer Iversen** from Aarhus University in Denmark and Prof. **Owain Pedgley** from Middle East Technical University in Turkey. It was not just an examination procedure, rather this process greatly enhanced my work as I rethought and remedied the manuscript based on their comments and recommendations. I also wish to express my great respect and appreciation to my old professors, **Byunghoon Choi** and **Eun Baek** from

Hongik University as well as **Simo Heikkilä** from the University of Art and Design Helsinki (currently, Aalto University) for building in me the foundation of and understanding of furniture design.

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rience led to my motivation to conduct this doctorate research, *Tangible ideation:* How to design *for* and *with* children?

Finally, I must mention my enormous thanks to my family: to my husband **Inje** for his often unvoiced, but strong and full support; to my adorable daughter **Yuna** for giving me so much enjoyment and happiness; to my parents for having absolute faith in me; and to my brother for his warm support. Thank you all my dear friends for cheering me up all the time. The door to this adventure is soon closing, but another one will surely soon beckon. I am more than excited to continue further journeys with more children with this *Tangible ideation*.