

Connecting Through Play

Creating more meaningful interactions
between children and their parents and
carers through play.



Research Dissertation by Benjamin Hermann (n10138901)

A close-up photograph of a child's hand interacting with a colorful abacus. The abacus has several horizontal rods with beads in various colors: blue, orange, white, green, and yellow. The child's hand is positioned in the lower-left foreground, with fingers touching the green beads. The background is softly blurred, showing more of the abacus structure.

The predominant emotions of play are interest and joy.

(Grey, 2013)

Abstract

The purpose of this study is to compile a list of design criteria to assist in the design and development of a toy or product that promotes play, provides early childhood developmental benefits, and encourages parents/caregivers to interact more with their children. Play is critical to early childhood development and essential for the development of important life skills. This includes the development of social, physical, cognitive, and emotional skills. Play provides parents with opportunities to engage with their children and build a solid relationship base and is essential for social and emotional development.

This report looks at the importance of early childhood development (ECD), the impact that play has on children, the challenges parents face when engaging with their children, and what toys can do to address some of these factors, if any. First, however, we need to understand the activities and toys that children currently enjoy. What developmental aspects should we focus on when designing toys and how can we understand how to better engage both children and parents/carers in play. When do they spend time together and how do they use that time?

First, literature was examined on the topics of ECD, play, benefits of play, challenges faced by parents, and toy design. The study highlights the importance of providing children with developmental opportunities in a variety of settings and focusing on designing toys that meet the needs of children and their parents. To establish a baseline and understand toy/activity trends, a questionnaire was completed by 56 participants. Additionally, 30-minute interviews were conducted with 10 participants from five families, followed by a cultural probe completed by each family.

The main conclusions from the study were that toys influence the development of key skills in children, but also that parents often have difficulty engaging with their children during play because they have few common interests. Constructive play, the use of blocks and building, was the most common type of play that engaged both children and parents. The activities that both groups enjoyed the most were outdoor activities and there is an opportunity to combine these in ways that appeal to both children and parents to make the time they spend together more meaningful.

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Image - (Kelly, 2021)

Introduction

United Nations International Children's Emergency Fund (UNICEF) is responsible for providing humanitarian and developmental aid to children worldwide. Along with children needing health, safety, and education, they recognise play as one of the vital elements of childhood development (UNICEF, 2018). Play is just as important to nurturing healthy children as a well-balanced diet or safe environment.

A child's brain is developing at its fastest during the first 1000 days of life. Early childhood development (ECD) covers the development of physical, social, emotional, cognitive, and motor skills from birth up until the age of 8 years old (Shastri, 2019). Providing opportunities to excel during this time should be the focus of every parent. And the time spend between a parent and a child is one of the best ways they can learn and develop.

But many parents struggle with knowing how to interact with their children or what interactions are meaningful to their development (Hayden, Gioia & Hadley, 2005). For such an important part of a growing child's life, why don't we know what they need?

The aim of this project is to gain a greater understanding of early childhood development (ECD) and the way that parents/carers and children can interact in more meaningful ways through play.

We are finding it harder to balance work, social and family commitments than ever before, but we know that not giving our children the attention they need can negatively impact our relationship with them (Isaacs, 2016). Play is one of the most enjoyable ways to interact with a child we need to look at how we can create more meaningful interactions with our children and make the most of the time that we have available.

This report aims to review existing literature on early childhood development and the importance that this has for children. It will also look at the challenges that parents/carers face focusing on ECD and what prevents them from spending time with their children. There will also be a study into children's toys and if there are any design considerations that address ECD along with what drives purchasing decisions.

It is important to make connections between ECD, play, challenges parents/carers face and the limits of exciting toy design. This will give us a better understanding of the importance of play and how we can make interactions between a parent/carer and their child more meaningful. By understanding how children play and what they look for in play-related artifacts we can develop a solution that addresses the needs of children, and at the same time places more emphasis on parents/carers being a vital part of their children's early development.

The SōZō Play system is a flexible modular system that that allows for parents/caregivers to cooperate in building different play structures, modify them using everyday item from around the home and play with their creation either in their home or outside/doors.

It is made up of various size block that can be joined using pins and straps and accessories such as wheels, hoses, and handles. When combined these parts can be made to build (but not limited to) climbing blocks, ride-on car, balance board, toy house or tower. These items can be further customised using the unique SōZō pin and nut system to connect cardboard boxes or other common household items.

Project Structure

ONE



TWO



THREE



FOUR



Initial Research

Literature Review

- Research Topics
 - Understanding Childhood Development (ECD)
 - Play and its Importance to Child Development
 - Challenges Parents Face
 - Toy Design (for children)

Analysis & Key Findings

Research Design

Methodology & Strategy

- Questionnaire
- Interviews
- Cultural Probe

Finding Connections

Finding & Analysis

- Questionnaire Findings & Analysis
- Interviews & Cultural Probe Findings & Analysis
- Data Analysis

Discussion

Recommendations

Proposal

Design Proposal

- Possible Solutions

Conclusion

Literature Review



The following works cover a range of research into four main focus areas of Early Childhood Development.

BRIEF OVERVIEW

To gain an insight into Early Childhood Development (ECD) and ways to build more meaningful interactions through stimulating play, research was undertaken in the following four areas.

First was understanding the importance of the early childhood stage of life, to better discover their needs and benefits from an educational perspective. The second area of research dealt with defining meaningful interactions and the importance of children interacting with parents/carers. The third area of research focused on the roles that parents and carers play in early childhood development and the limiting factors that prevent spending time with their children. The final research area related to designing toys for play and development.

FOCUS AREA ONE

Understanding Early Childhood Development

Early Childhood Development (ECD) happens from birth until the age of around 8 years old (Shonkoff & Phillips, 2000) and is the period where a child's brain is developing the fastest. This is referred to as the first 1000 days of a child's life (UNICEF et al., 2018) and recognised as an important time for building the fundamental building blocks that will impact someone throughout the remainder of their childhood and into adulthood.

The development of cognitive skills, emotional well-being, social competence and sound physical and mental health builds a strong foundation for success well into the adult years (Shonkoff & Phillips, 2000).

Parents play a vital role in the early development of children's social and emotional foundations (Greenberg et al., 1993) and these foundations can have both negative or positive impact on a child's ability to succeed in school and into their adult life.

This development can take different forms and is influenced by social, economic, and cultural backgrounds. However, much research has been done on the factors of play during ECD and overwhelming evidence points to the existence of five key contributing characteristics of play (Smith, 2008; Gleave, 2012). These characteristics include play that is meaningful, joyful, interactive, actively engaging and socially inclusive (Zosh, 2017).

Play is used by children to help build their understanding of the world around them. This is done through connecting new experiences to something of which that has familiarity to them. It is through these connections and understandings that play becomes meaningful (Smith, 2008). But this cannot be done in a static manner. Play needs to include interactions allowing children to try different possibilities, hypothesize, and discover new ways of solving problems. This builds practical skills that build on the meaningful experiences they observe (Gleave & Cole-Hamilton, 2012).

One of the challenges that children face is the lack of control over their environment and economic position. It is estimated that more than 40% of children in low-middle income countries are at risk of not achieving their full development potential due to poor ECD (Shastri, 2019). This has a onflow effect and has lifetime impacts for a child, limiting their own opportunities and negative outcomes for these children can also result in a high cost to society (Sayre, Devercelli, n.d., 2015).

UNICEF recognises the importance of ECD and has a number of programs and goals in place to tackle the challenges that children all over the world face (UNICEF et al., 2018). An example of a program that is focused on learning through play is ReachUp, based on a study done in Jamaica (Gertler, Heckman, Pinto, Zanolini, Vermeersch, Walker, ... & Grantham-McGregor, 2014). By arranging for community health workers to visit new parents living with minimal resources and teaching basic parenting skills and encouraging play, this program has shown impressive results for their children. Results showed higher cognitive development, mental health and social behaviour skills compared to children that did not participate in the program.

Ramey, Sparling & Ramey (2012) published findings on the Abecedarian approach, where 111 children were provided with basic nutrition, supportive social services, and health care

for the first 5 years of their lives. 57 of these children also received high-quality day-care services with specially designed activities to encourage engagement and fun (Ramey, Sparling & Ramey, 2012). Children who had received the additional attention had higher education levels, and were more likely to have full-time, higher paying jobs. This study was not without its critics, Spitz was concerned with the effectiveness of the program (Spitz, 1992), and the high cost of the program makes large scale adoption difficult (Masse & Barnett, 2002).

FOCUS AREA TWO

Play and its Importance to Child Development

Play is a fundamental part of a child’s development and help to develop physical and social skills, creativity, imagination, cognitive skills, like language and comprehension and independence (Tom & Gisli, 2018, p. 32). “Play is the chief vehicle for the development of imagination and intelligence, language, social skills, and perceptual-motor abilities in infants and young children” (Frost, 1992, p. 48). It is through play that children can explore and discover more about themselves and the world around them. “Through play, children develop language skills, their emotions and creativity, social and intellectual skills.” (Early Years Matters, 2017).

“Play is one of the most important ways in which young children gain essential knowledge and skills.” (UNICEF, 2018)

Hurwitz article “To be successful--let them play!” outlines five play categories, these include:

- Practice play - doing something repeatedly for pleasure.
- Constructive play - building or assembling something.
- Rough and tumble play - pretending and having fun (laughing).
- Dramatic play - role playing.
- Games with rules - games that have conditions and rules.

It is through the understanding of these different types of play and how they each aids childhood development, provide parents guidelines for their children’s activities (Hurwitz, 2002).



Adapted from Components of Nurturing Care (World Health Organization, 2018)



Adapted from Children are born to learn through play (Zosh et al., 2017)

Intellectual Development Through Play

The idea that children can look at a problem and form several solutions, even if it is through trial and error, can be directly linked to the types of play and interactions that children have been exposed to (Dansky & Silverman, 1975). For children, the act of playing with a variety of objects and tools, helps build a set of rules and associations that will allow them to develop their divergent problem-solving abilities. This exposure is what helps to develop problem solving skills and gives a child the fundamental skills that they carry into later stages of their lives (Hughes, 1999).

There is also a link between make believe-play, pretend play, and creative thinking that help build a child's ability to think in an abstract way. This abstract thinking shows remarkably similar thought processes in adults, allow children to be able to generate different solutions that imitate the thought processes required for divergent thinking tasks (Dansky & Silverman, 1975, p. 104). Play and creativity in children are one and the same and it is through play that these skills are developed.

Hughes (1999) discusses the limitation of the research that that has been done in this area and states that while we understand there is a link between play and the development of intellect, there is "no genuine experimental research on the effects of specific types of play on later cognitive development." (Hughes, 1999, p. 171).

There are many other factors to consider in relation to developmental growth, including the relationship between a child and parent, educators, peers, and the environment that the child is part of (Susa & Benedict, 1994, p. 564).

Language and Social Benefits of Play

Children explore their language skills through the medium of play and tasks. Their vocabulary can be built upon through the simple task of touching and sharing objects with a parent or carer who is able to verbalise these actions (Holmes & Romeo, 2018). The mechanisms between play and language development are not fully known, but it has been shown that over time that increased play with others has an impact on the speed in which a child's language improves (Brown & Prescott, 1997).

Two to seven-year-olds find it difficult to process and use their logical processing skills enough to be able to deal with the day-to-day challenges that life presents, but this is where make-believe plays provide a key role in developing these skills (Caplan & Caplan, 1973). Caplan discusses how make-believe play allows children a level of freedom and control of a world that they can master and manipulate. An example would be playing with a doll and offering it food or toys. This leads to building better social skills and peer acceptance. Hughes (1999) observed that more popular children were more likely to share play equipment with their peers and be more cooperative during play. They would often lead play activities with others but would

allow others to take over once the activity had started (Hughes, 1999). It was also noted that less popular children tended to show unsuitable social behaviours and were less willing to share.

The importance of interactions between children and parent is well documented. Research shows that the promotion of learning starts from an incredibly early age, particularly in regard to spatial development (Jirout & Newcombe, 2015; Ribeiro et al., 2020). Spatial development refers to the capacity to recognise objects in different orientations or the physical manipulation of object in a 3D scape. Parents have an opportunity to develop their children’s spatial understanding through guided interactions that include showing how to do something, speaking and instructions. Children who interact this way show much higher learning capabilities than that of children that do this independently (Wood, Bruner, & Ross, 1976). It is through this guidance, that prevents children from becoming frustrated, and allows for exploration through suggestion.

Known as parent scaffolding, introducing new ideas that assist and encourage learning, not only assisting the development of their learning skills but also their ability to engage with others (Wood & Bruner, 2016, p. 2). Two-year-olds start

to involve their parents in general activities, but from about three children start to direct their play activities to include their parents with items such as puzzles, toys or drawing activities (Wilson & Durbin, 2013).

FOCUS AREA THREE

Challenges Parents Face

Child and parent interactions through play is important and vital to the exercising of their creativity and imagination, dexterity, physical, cognitive, and emotional development (Tsao, 2002, p. 230), but for some parents being able to give their children the time and attention they need can be challenging (Ginsburg, 2007, p. 2).

Do parents/carers understand what children need?

There are wide-ranging reasons for parent/carer limitations on providing childing with meaningful interactions and play. Ayob, Christopher & Naidoo (2021) identified several reasons, but a lack of information was a recurring theme across publications. “Caregivers indicated that they required information to further their knowledge



Adapted from Balance of child-adult involvement and constraints (Zosh et al., 2017)



“Play is one of the most important ways in which young children gain essential knowledge and skills.”

(UNICEF, 2018)

on child-rearing and how to accomplish positive outcomes through their practices” (Ayob, Christopher & Naidoo, 2021, p. 9). Many parents feel that they lack the skill or access to the information they need to raise their children in a way they will support them later in life (Pellegrini & Boyd, 1993). While some parents claim to lack information, others are overwhelmed by the amount of literature and conflicting information. Ginsburg talks about how parents are pressured to ensure that children are “provided with the best opportunities” and can overschedule their children with after school activities and developmental programs (Ginsburg, 2007, p. 184). This results in both children and parents

that are so busy they do not have time to spend quality time together in unstructured play. The overscheduling can also lead to unnecessary pressure on a child and increase anxiety possibly leading to depression once the child enters school (Elkind, 2007).

Time is a major factor

Lack of time is another challenge that parents and carers often present as a limitation for interaction opportunities with their children. Today we are working longer and harder than any previous generation and it is common that both parents (in households with two parents)

Play is meaningful

Children play to make sense of the world around them, and to find meaning in an experience by connecting it to something already known. Through play, children express and expand their understanding of their experiences.

Play is joyful

Look at children - or adults - playing, often smiling and laughing. Of course, play may have its frustrations and challenges (Who gets the first turn? Why can't I make this block building stay up?), but the overall feeling is one of enjoyment, motivation, thrill and pleasure.

Play is actively engaging

Watch children playing, and you will usually see that they become deeply involved, often combining physical, mental and verbal engagement.

Play is iterative

Play and learning are not static. Children play to practice skills, try out possibilities, revise hypotheses and discover new challenges, leading to deeper learning.

Play is socially interactive

Play allows children to communicate ideas, to understand others through social interaction, paving the way to build deeper understanding and more powerful relationships.

Adapted from Play takes many forms (UNICEF, 2018)

work and care for their children (Pencavel, 2018). In homes where there is only one primary carer this is even more of a challenge (Van Gasse & Mortelmans, 2020).

Ginsburg outlines several factors that have contributed to the decrease in the amount of available time parents have today. These include two working parents, single parent homes, fewer multigenerational households (access to grandparents), a reduction in work/life balance, increased use of day-care services, pressure to involve children in multiple programs or activities, and preparing children to perform better academically (Ginsburg, 2007, p. 185).

Digital Distractions

There is also the distraction of television and digital devices. Danet (2020) conducted research into how parents showed concern for their children's use of digital devices, but also discovered that children recorded their parents using computers and smart phones excessively. This took them away from time that could be spent with their children (Danet, 2020, p. 2897). The effects of television and viewing habits have also been noted as a source of distraction that prevent parents from engaging with their children (Skaug, Englund & Wichstrøm, 2018).

FOCUS AREA FOUR

Toy Design for Children

In the book 'Designing for Children: Marketing Design that Speaks to Kids', Fishel looks at the challenges that designing for children has and the opportunities that this audience presents. The message is quite clear that listening to children and understand their wants and needs will lead to better design (Fishel, 2001). Even though this book is a dissection of marketing and advertising campaigns directly aimed at children and relates more to marketing point of view, the design ethos that toys need to delight, inform, and satisfy apply to designing products for play.

Focusing on the development of social skills 'Designing Toys and Play Activities for the Development of Social Skills in Childhood' (Tonetto, Pereira, Koller, Bressane, Pierozan, 2020) looks at how toys for children aged 5-7 can be designed to focus on developing social skills. It provides evidence that many current toys on the market provided any addition to the development of socialisation skills and provides

15 ways that social skills could be stimulated by toys. These can focus on the building of social skills including the expression of emotions, empathy, making friends and building cooperation and problem-solving ability. While this paper centres on play between children and improving social skill with children's peers, many of the suggestions made are also relevant to the relationship between a child and parent.

Page & Thorsteinsson, in 'Designing toys to support children's development' discuss the importance of designing toys for both the child and the parent of the child. Toys not only need to appeal to the fancies of a child, but also offer some educational benefits to convince the parent to purchase, and toy designers must balance both consumers' needs when designing. This is in opposition to ethos at LEGO, who want children to reach their own potential and focus on designing for the children and not the parents (Lego, 2021). There has also been a rise in pocket money that children are receiving, and this gives them a buying power that toys companies are taking advantage of. The research also found that simpler toys allow for children to be the "masters of their own play" and are more desirable than overly complex products (Page & Thorsteinsson, 2017).

When researching the importance of play on childhood development, Hurwitz outlined the play categories: conditional play; constructive play; role play; and practice play (Hurwitz, 2002). In 'The Play Pyramid: A Play Classification and Ideation Tool for Toy Design' (Kudrowitz & Wallace, 2010) the writers take a similar approach by concentrating on challenge, construction, fantasy, and sensory play types when designing toys for children. These themes are then used to support a platform for product concept generation and ideation. This is a tool that can be used by designers to analyse their designs and dissect other products on the market to find possible gaps or opportunities.

Toys can often be seen as throw away items and something that have short life spans. In 'Beyond Child's Play: Sustainable Product Design in the Global Doll-Making Industry' (Edward, 2010) the impact of the toy industry on the environment is explored with the intent of highlighting the entire ecosystem that this industry affects. Designing toys for children should not only be focused on benefiting them directly through play but should also consider the impact that making these products has on places where children live and the environment, society and economy that will support them in the future.

SUMMARY

The importance of ECD is well documented and the benefits of providing children with the core building block for key life skills will provide them with the best opportunity to succeed in life (Shonkoff & Phillips, 2000). Parents play a huge role in helping to develop these skills and how they interact with their children can have both positive and negative influences. Play is recognised as a key factor in how children learn and explore, helping them to understand the world around them and build vital problem-solving skills (Gleave & Cole-Hamilton, 2012).

Play is not only important for Children, but according to Article 31 of the United Nations Convention it is the right of every child to be able to play (Tom & Gisli, 2018, p. 32). Not all children grow up in ideal situations, but small changes to how children are raised can have a huge impact later in life. By providing children with high quality learning opportunities children can improve cognitive development, mental health and social behaviour skills (UNICEF et al., 2018).

There are different types of play that help develop different aspects of a child's developmental needs. Practice play, constructive play, role-play, pretend and fun games all work together to give children the best opportunity for success (Hurwitz, 2002).

While parents' involvement with their children is proven to be important, there are several challenges that parents face. From busy lifestyles to over scheduling and work commitments, parents are finding it harder to make time for their children (Ginsburg, 2007, p. 184). This combined with parents lacking information or being overwhelmed with conflicting information struggle to understand what it is that their children need. But television and digital devices habits are also responsible for taking time away from parents spending time with their children (Danet, 2020, p. 2897). Changing these habits and providing a better way of delivery information to parents regarding the importance of ECD can help increase quality time together.

The toy industry is a profitable industry, and there is a lot of research into designing toys for children. Much of the literature can be more focused on marketing, but it has been clearly identified that designing for children must involve meeting the needs of children to be successful (Fishel, 2001). Designing toys aimed at parents for children can be beneficial, as they are usually making the purchasing decision, but overcomplicating the design or focusing too much on educational elements can reduce its appeal for children (Page & Thorsteinsson, 2017).

What is the gap?

The positive aspects of parents spending time with their children is well documented, and play is recognised as being one of the key mechanisms through which children learn during ECD. Through reviewing the current literature on ECD, learning through play, challenges faced by parents and designing for children the following gaps were identified in the research:

- Children benefit from quality ECD programs, but are there any benefits for the parents other than providing their children with the best possible outcome?
- Can intervention of ECD program later in a child's life still, but before the age of 8, produce positive benefits?
- How do the current toys on the market address ECD?
- How can a product or service designed for improving ECD, address the concerns parents have around information and time?
- How can toys be designed in order to facilitate meaningful interactions between parents/carers and their children



Play is far more powerful for children, however, than many parents realize. **It's actually the key to learning.**

(White, 2012)

Methodology

Research Design

INTRODUCTION

Qualitative research was conducted to gain a deeper understanding of parent and carer interactions with their children, what they consider meaningful, their understanding of early childhood development and children and parent's toy preferences. Due to ethical restrictions on collecting data from persons under the age of 18, this research focused on obtaining data from parents (rather than directly from their children). This limited the data collected, however will still provide vital insight into how it is possible to create more meaningful interactions between children and their parents/carers through stimulation play during early childhood development.

The methods selected for obtaining this data include an online questionnaire, semi-structured interviews, and a cultural probe (figure 2). These methods will provide a wide range of data that will cover all aspects of the research brief I am planning to address. This strategy of using triangulation research (Bekhet & Zauszniewski, 2012) will allow for design opportunities to be identified across multiple investigative methods.

Figure 2 - Research Methods

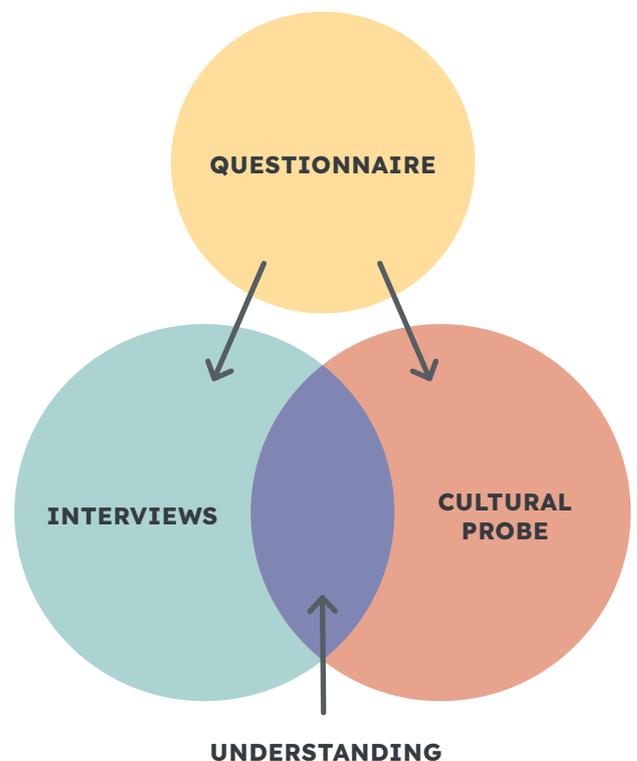


Figure 3 - Methodology Timeline



QUESTIONNAIRE

Participant Selection

The questionnaire was conducted online with recruitment made through social media platforms, and online parents' groups (with permission). Requirements for participants to take part in the questionnaire included, being over the age of 18, and currently the parent of a child between the ages of 12 months and 12 years old. It was also desirable that the participant be involved in the child's life on a regular basis (at least once a week) and involved in toy purchasing decisions (within the last 12 months). Participants that did not qualify for the questionnaire were unable to proceed past the preliminary questions.

When/Time

The online questionnaires were distributed and open to participants between April 19th and April 25th, with analysis of the data taking place between April 26th and 28th.

Procedure

Participants received links directing them to complete the online questionnaire through posts made on social media platforms, and online parents' groups. They were asked to provide consent to participate. The questionnaire was anonymous, with consideration taken into account to reduce bias in both questions and answers.

Preliminary questions were asked to ensure participants would qualify to continue. Base information regarding geographical location, age, gender, household income and age of the child was collected to improve data analysis and determine a broad range of participants were captured.

The main focus of the questionnaire was to collect information relating to parents' knowledge of ECD, the influences and decisions that go into toy purchases and the challenges parents face balancing time with their children and other commitments. The questionnaire had a total of 16 questions and made up of multiple-choice, Likert scale and open-ended responses. The open-ended responses were used when more details were required. A copy of the questionnaire can be found in **Appendix 1.1**.

INTERVIEW

Participant Selection

Interviews were conducted online using video conferencing software, with the interviews being recorded and transcribed. Participants were recruited through in-person meetings, pre-established networks, social media, and online parents' groups (with permission). Requirements for participants to take part in the interviews included, being over the age of 18, and currently the parent of a child between the ages of 12 months and 8 years old. It was also desirable that both parents (where relevant) be involved in the interview. Participants were also required to have access to a digital device that facilitates video conferencing software (including a microphone).

When/Time

Interviews with selected participants took place online between April 24th and May 2nd, with transcoding and analysis taking place between May 6th and May 7th.

Procedure

After being selected to participate in the interviews, participants were asked to sign and return a consent form. This included the recording of video and audio and data usage. Participants were also made aware of the ability to withdraw at any time and how to do this. Once received interview dates and times were scheduled with the participants. Before starting and the interview being recorded participants were given a brief overview of the research project, the types of topics that would be covered and asked if they would like to proceed.

The interviews were planned to last approximately 30-40 minutes; however, allowances were made to extend this time if the participants were willing and had additional information to provide.

A semi-structured approach was taken for the interviews, this ensured that questions relating to the necessary topics were covered, but also allowed for follow up questions further discussion to take place.

Topics focused on:

- How parents play with their children?
- What types of games do they play?
- How often they spend time with their children?
- How important they perceive their time together?
- What other activities their children participate in?

A copy of the preliminary interview questions can be found in **Appendix 1.2**.

CULTURAL PROBE

Participant Selection

The cultural probes were conducted through email and online using video conferencing software, with participants provided with an information pack with detailed instructions and examples for them to follow. Participants were recruited through the same method as the interviews and most participants were also involved in the research interviews. Requirements for participants to take part in the cultural probe included, being over the age of 18, and currently the parent of a child between the ages of 12 months and 8 years old. It was also desirable that both parents (where relevant) be involved in the cultural probe activities. Participants were also required to have access to a digital device that facilitates video conferencing software (including a microphone), and a digital camera.

When/Time

Cultural probes kits were issued to selected participants (generally after participating in the research interviews) between May 1st and 9th (2021), with follow up meetings to help complete the workbook tasks approximately 5-7 days after the kits were issued. Analysis of the data collected happened between May 3rd and 10th.

Procedure

After being selected to participate in the cultural probe, participants were sent a welcome pack and asked to sign and return a consent form. This included taking photographs, keeping a diary, and completing some workbook activities (assisted through a follow-up video meeting) and data usage. Participants were also made aware of the ability to withdraw at any time and how to do this. Participants were given 7 days to complete the activities and complete the diary before returning it, via email, to myself. It was noticeably clear to all participants that no photographs were to be taken of children or anyone under the age of 18 (none of the activities required images of people to be taken).

The cultural probe consisted of the following:

- Cover letter and thank you message
- Instructions on the requirements of the dairy activities (including an example)
- Instruction on the photos that were required to be taken (including an example)
- Instructions the workbook tasks that were to be completed (to be complete during the follow-up video meeting).

The cultural probe aimed to help understand children's play spaces, the types of toys they own, what toys they like to play with and the schedule of both parents and their children.

A copy of the cultural probe welcome package can be found in **Appendix 1.3**.

Experiments

To ensure that the primary data collected was useful to the research project and that the participant experience would be frictionless, several experiments were conducted. This included several revisions to the questions, processes and trial deployment to ensure quality data was being collected.

QUESTIONNAIRES

Before the questionnaire was deployed the questions went through several test stages and iterations to ensure that they made sense to participants and the data collected was beneficial to the research project. To test the questions the first draft was distributed to four fellow researchers. They completed the questionnaire, provided comments and feedback on the questions presented and then discussed the answers provided. Several changes were made to the questionnaire questions, concerning wording and structure, and the was distributed to the same group for a second round of reviews. A few minor changes were made, and the questionnaire finalised.

As the fellow researchers did not fall within the target user group, the questionnaire was distributed to a small group of test participants (three). This test group was made up of colleagues that met the questionnaire requirements. The results were reviewed and contact made with the test participants to clarify some of the answers given or issues noted with the responses.

Minor changes were made to the questionnaire questions and some of the questions reorganised. The questionnaire was then finalised before being publicly distributed.

INTERVIEWS

Based on the questionnaire results combined with themes recognised from the literature review, several interview topics were identified to form the basis of interview questions. The questions were structured around obtaining answers to the gap questions outlined in the earlier literature review summary (pg 16). The interviews were semi-structured and therefore the questions written were designed only to guide the interviewer to ensure the main themes and topics were covered.

Two initial test interviews were conducted to refine the interview process. The first test was conducted with a fellow researcher who met all the requirements of the defined user group to make sure their responses were genuine. The purpose of this test was to determine if the questions were understood by the participant and their responses were able to fulfil the research needs. Before the interview started the purpose of the research was explained, it was confirmed that consent was given and, if they agreed to be recorded (although the test interview was not being recorded), and if they understood they could withdraw from the research if desired. The interview was conducted with comments and feedback given throughout the process to help refine and improve the interview structure.

The second test interview was conducted with a participant recruited through social media. This person met all the conditions of the user group. This experiment followed all the processes and structure of the final interview, including completing consent forms, agreeing to be recorded, and several other pre-interview checklist items. This process was conducted to ensure that all technical aspects of the interview went smoothly and without any issues. The audio recording was done through Zoom and tested using the Zoom application (user end) and via a phone dial-in connection. Both tests were successful. Some minor suggestions were made regarding the interview structure and question, but overall the second test interview was successful.

Recruitment of the final interview took place on social media and participants that agreed to participate were sent information packs and example questions before the interviews took place.

CULTURAL PROBE

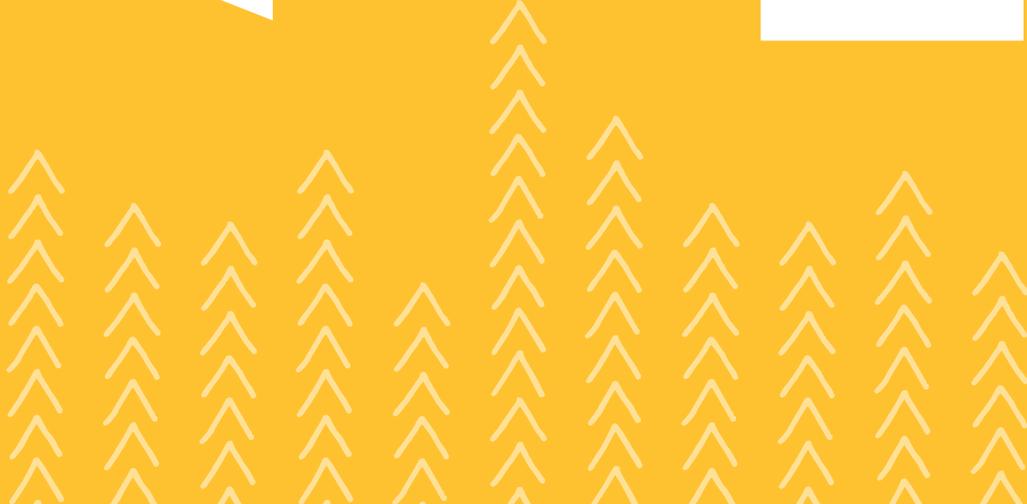
The cultural probes were completed by the same participants who took part in the interviews.

To test the cultural probe process, an instruction guide/procedure was provided and then tested by an associate. This allowed for direct observation of the second and third tasks (the first being a written task). Issues around capturing and importing images into the supplied document became apparent and as a result, changes were made to the way users completed the tasks. Instead of requiring the participants to insert and comment on photos in a supplied document. There were required to provide the images to the researchers directly and a follow-up interview was then conducted to obtain the required information (comments).

This put less onus on the participants and made it more likely that they would complete the tasks.

Instructions and consent forms were sent to the participant at the conclusion of the interviews.

Analysis and Findings



ANALYSIS

The questionnaire data was analysed using by exporting the results from Google Forms and importing them into a Microsoft Excel spreadsheet. All data was then analysed with standard statistical tools. Exporting the data set for the questionnaire data generated various results. The data was broken down into four main parts: Demographics; Early Childhood Development; Time; and Play & Activities. The data in each section was compiled into charts and crossed analysed where relevant (see appendix 2.1).

The interviews were analysed using inductive coding. This is where a set of codes are generated based on the qualitative data itself. All codes were generated from the interview responses and built up into a table as they were being analysed (see appendix 3.1). A flat coding frame structure was used.

The coding table was made up of four main topics: Play; Time; Childhood Development; and Activities. Each theme contained several sub-themes.

Multiple passes were made for each interview and a frequency table generated based on how often a certain theme was mentioned.

This data combined with insights noted during the interview process formed the basis for the results.

The cultural probe was made up of three activities, this included logging time spent with children playing, photographing play spaces, and categorising toys/artifacts into three subcategories.

The time logging data was tallied in Microsoft Excel and summarised for the analysis (see appendix 3.3). Images for the second and third tasks were analysed using a flat coding frame structure to determine the types of play space, size and features of toys that made them desirable or undesirable (see appendix 4.2).



Image - (Toochinda. T, 2018).

QUESTIONNAIRE FINDINGS

The questionnaire covered basic demographics such as age, gender and household income. The questions then focused on three main areas of study: knowledge around early childhood development; time management and time spent with children; and play and activities, including toys and artifacts used.

Demographic

A total of 56 participants took part in the online survey. Of the participants 78% identified as female and 22% as male (see figure 5). More than 60% of participants fell between the ages of 36-44, with the second largest age bracket being 30-35 years olds with 24% of the questionnaire responses. All other age brackets accounted of the remaining 16% (see figure 4).

More than 96% of participants had either one (50.9%) or two (45.5%) children between the ages of 1 and 8 years old, living with them on a regular basis. Only two households reported three or more children in the home (see figure 6). 13 participants responded having children under the age of 12 months old, however these respondents also had children that qualified them to participate in the study (a second or third child that was between the ages of 1 and 8 years old).

Of the 56 participants, 41 lived in Brisbane, 4 lived in greater Queensland, and the remaining participants were in Melbourne (4), Sydney (2), Wollongong (2), Tokyo (2) and London (1). Household incomes were broken down into five brackets. These included \$50,000-\$74,999 accounting for 13.5%, \$75,000-\$99,999 accounting for 9.6%, \$100,000-\$149,999 accounting for 44.2%, \$150,000 and greater accounting for 26.9%, and participants that would prefer not to report their incomes accounting for 5.8%. Participants combined annual household incomes that exceeded \$100,000 made up more than 70% of respondents. This figure falls within the Australian nationwide median income of \$49,805 for individuals, and \$110,084 for households, reported by the Australia Bureau of Statistics for 2020.

Figure 4 - Age of Respondees

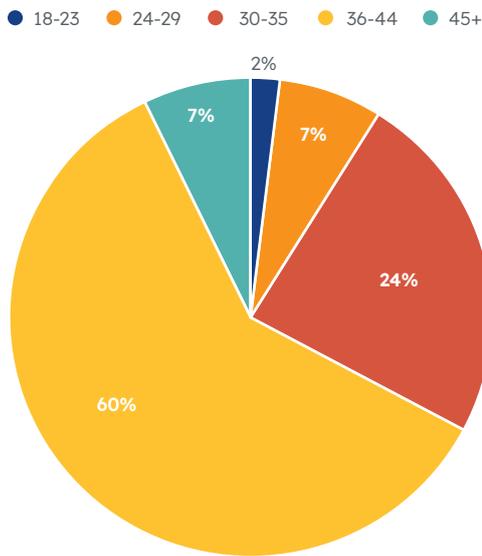


Figure 5 - Gender Split

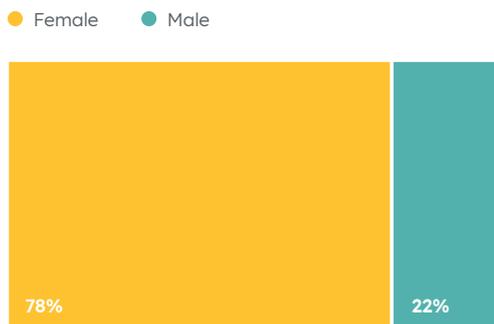
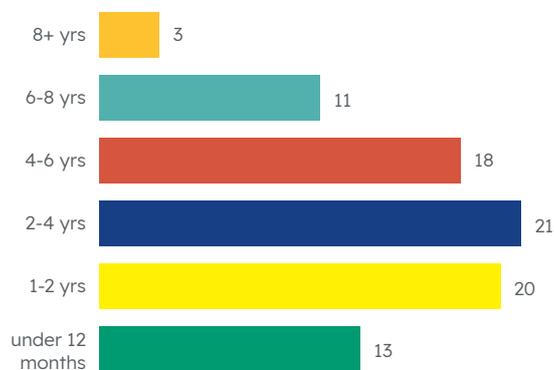


Figure 6 - Child's age (years)



Early Childhood Development

To understand participant's perceived knowledge of Early Childhood Development (ECD) a Likert scale was used, and participants asked if they strongly agreed through to strongly disagreed (5-point scale) in relation to several questions. When rating their own knowledge of ECD, the majority considered themselves to be somewhat knowledgeable (30) or well versed (19). When asked about the easy of accessing information in relation to ECD, again most participants considered accessing this information somewhat easy (25) or easy (27). Almost all participants (50) strongly agreed that play was an important part of their child development (see figure 7).

Time

Of the 56 participants, 48% disagreed that their schedule made it hard for them to spend time with their children, with 26% agreeing that their schedule somewhat affected the time they were available. The remaining 26% agreed that their work schedule made it hard for them to spend time with their children (see figure 8).

When asked how much time participants spent with their children on average per week, 42% spent more than 10 hours a week with their children, 30% between 5-10 hours, 24% between 3-5 hours, and 4% spend two or less hours with their child per week. However when asked how satisfied the participants were with the amount of time they spent with their children on a scale of 1-5, with 1 = very unhappy and 5 = very happy, 50% were either happy or very happy, 21% were neutral and 29% were unhappy with this time (see figure 8).

Play and Activities

Participants were asked what activities or games they enjoyed doing with their children. These responses were put into nine different categories. Out of the 76 activities listed, the most popular category was outdoor activities accounting for 32% of the activities noted. The second most popular activity was creative or arts-based activities accounting for 15%. 10% was attributed to role play and imagination, and further 10% to singing and dancing activities. Building and construction (Lego) (8%), board and video games (8%), and reading and learning (8%) activities all scored the same percentage. Home activities such as cooking and general play and mischief made up the remaining responses (see figure 9).

Figure 7 - Early Childhood Development

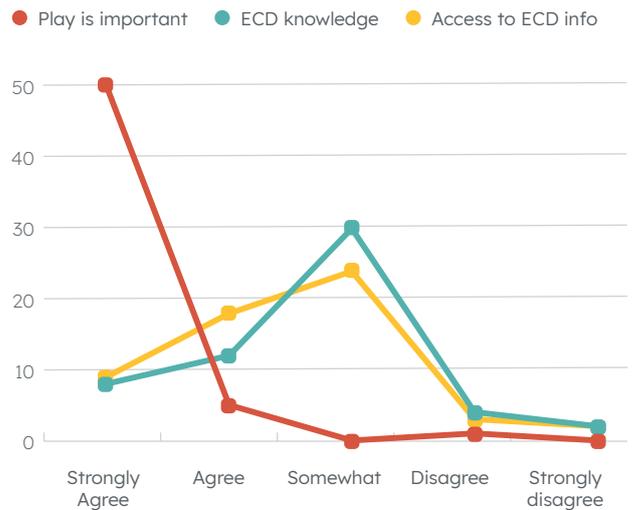


Figure 8 - Time Spent Together vs Time Satisfaction



Figure 9 - What is a game or activity that you do with your child that you really enjoy together?

Activity	Responses
Outdoor Activities	24
Arts & Creative	11
Role Play / Imitation	8
Performance Arts	8
Construction/Building	6
Games	6
Communication/Learning	6
Home Activities	4
Miscellaneous	3
Total	76

The frequency in which the participants purchased toys showed that 38% purchased toys a few times a year, 33% every few months, 18% once a month and 11% once every few weeks.

When considering the factors that influenced a parent's decision when buying toys, several categories were presented and ranked. Educational benefits, health/exercise, cooperative play, design, children's wants, and price/value all showed similar responses with the majority or participants considering these elements somewhat important. However, creativity was considered more important, and safety was considered especially important (see figure 10).

When comparing children's favourite toys against toys that parent preferred, the results provided some interesting findings. Books (8%), toy vehicles (14%) and miscellaneous (8%) were even across both groups with no preference either way. However, children showed more tendencies towards dolls and figurines (30% vs 22%) and imaginative/role play toys (4% vs 2%). While parents showed more tendencies towards outdoor or sports related toys (20% vs 15%) and building/construction toys (27% vs 20%). Overall, the most popular types of toys with children were dolls and figurines (41%), building/construction (37.5%), outdoor/sports (28%) and toy vehicles (21.5%) (see figure 11).

Figure 10 - When purchasing a toy or game for your child what factors do you consider important?

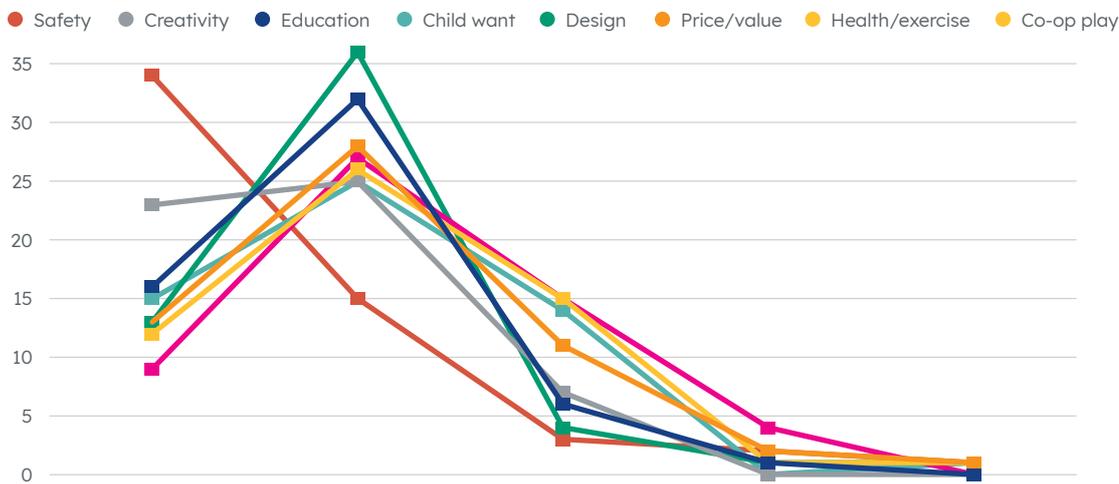
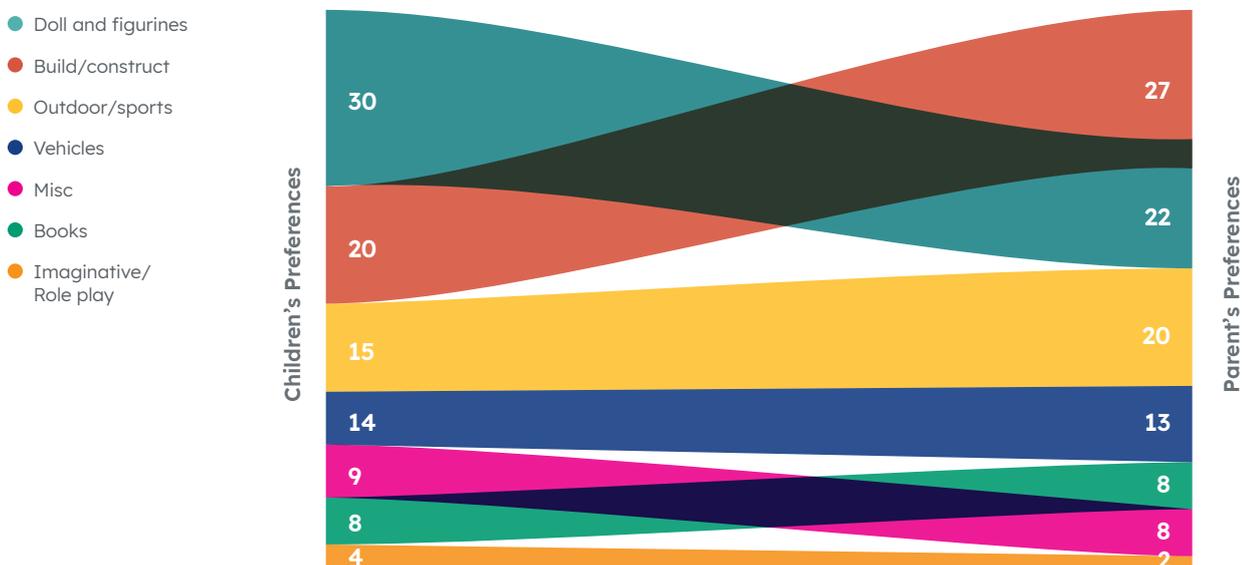


Figure 11 - Children vs Parents toy preference figure



INTERVIEW FINDINGS

Five interviews that included 9 participants, were conducted over the span of two weeks. This included four couples and a mother whose partner was unable to attend the pre-arranged interview time. Three interviews were conducted with participants based in Brisbane, one in based in Melbourne and the final based in Sydney (see figure 12).

Figure 12 - Interview Participants

	Location	Participants	Age	Children	Dwelling Type
Interview 1	Brisbane	Father & Mother	36-44	Two, Male (5) & Female (7)	Townhouse
Interview 2	Brisbane	Father & Mother	36-44	Two, Male (4) & Female (7)	Single Dwelling
Interview 3	Brisbane	Father & Mother	36-44	Two, Male (3) & Female (6)	Single Dwelling
Interview 4	Melbourne	Father & Mother	36-44	One, Male (12 months)	Apartment
Interview 5	Sydney	Father & Mother	36-44	One, Male (19 months)	Single Dwelling

All interviews were conducted online, and the audio recorded and later transcribed. The interviews were coded using inductive coding with a flat coding frame. The code categories included key themes based on play, time early childhood development and activities.

The first interview was with a married couple. The mother worked full time and had a demanding role, this left the father as the primary carer of the children. While most of the day-to-day activities were done by the father, the mother was involved in the bedtime routine and took charge on weekends organising activities and spent considerable time with the children on her days off. During the interview it was noted that the children did not have a particular connection with traditional toys, while they did follow some of the toy trends introduced to them by their peers, they mainly enjoyed participation in arts and crafts activities. They would also be more likely to play with toys that they had made than toys bought from a store. The family also got out of their home (townhouse) as often as they could as space was limited. Knowledge of ECD was high in both parents and the mother had a job that related to children development.

The second interview was also a married couple with two children. The mother ran her own business from home and the father worked a standard 9-5 job. Most activities were shared between the parents; however, the father had

stricter works hours and need to leave for work at a certain time. The mother was deeply knowledgeable regarding ECD having studied early childhood education. Both children were into arts and crafts, however LEGO was the toy of choice in this household. Both the parents and the children enjoyed playing with LEGO and often partake in family competitions or build challenges. The parents were against gender specific toys and encouraged their children to play with toys designed for everyone. This family had a big focus on their children and spent considerable time with both children daily.

The third interview consisted of a husband-and-wife team that both ran their own businesses from home. This meant that both their children were with them most of the time. There was a big focus on building life skills and the children being independent. The children mostly entertained themselves and would imitate activities that their parents were doing. For example, the mother ran an events business, and she might be making props for an event or flower arranging. The children would try and reproduce similar props or flower arrangement using things they could find around the house and garden. Again, there was a big focus on arts and crafts, but also being included in cooking together as a family. Knowledge relating to ECD was not lacking, but maybe focused on letting the children develop in their own time rather than expecting them to conform to societal expectations.

The fourth couple interviewed lived in Melbourne and had a one-year-old son. Both worked during the week and the child was in day care four days a week. Because of this, time with their son was limited to after work, at night and on weekends. Both parents lacked any external family support, without any relatives living close by. Most activities involved heading into the city, shopping, dining out and visiting cafes. They would also visit parks and local attractions. As their son was quite young (born 6 weeks premature) most of the play activities revolved around simple games, singing, doing actions, and exploring objects. Attitudes towards ECD were a take it as it comes approach, with some influence from social media and friends, but little research done online or through books. Sleeping and feeding challenges still consume a lot of time and free time is limited. Ongoing COVID restrictions in Melbourne also play a role in the number of activities this family were able to participate in.

The final interview was conducted with the mother that was married. The father was unable to participate in the interview due to other commitments. The mother works full time, but four days a week, taking Wednesdays off, and the father does the same taking Mondays off. Their son is in day care two days a week with a grandmother looking after him most afternoons. The wife's work situation is somewhat flexible and allows her to work from home a few days a week. This means that she can see her son multiple times a day during work hours. Main activities include going out to playgrounds and parks or heading to the shops. They also like going swimming when the weather permits and exploring the city. The child enjoys playing with Play-Doh, painting, drawing, and making bubbles. He like to explore and is very inquisitive. The mother was quite knowledgeable in relation to ECD spending her free time reading articles online or purchasing and reading books. Her biggest challenge was filtering the overwhelming amount of information and finding a way to determine what was good and bad advice.

Figure 13 - Interview Coding Results

CODE	Jess & Chris	John & Siona	Lauren & Jan	Richard & Shirley	Shelly & Pete	TOTAL	CODE		
PLAY							PLAY		
PFP	3	1	1	2	3	10	PFP	Free Play	
PGP	1	0	0	1	6	8	PGP	Guided Play	
PRG	2	2	1	0	0	5	PRG	Rules/Games	
PPLP	0	1	0	0	2	3	PPLP	Parent Lead Play	
PCLP	0	4	3	4	6	17	PCLP	Child Led Play	
PIP	3	0	2	2	11	18	PIP	Imitation Play	
PTA	4	3	10	7	29	53	PTA	Toy or Artefact	
PHA	0	0	2	7	5	14	PHA	Holds Attention	
PLI	1	1	1	2	7	12	PLI	Loses Interest	
PCR	9	12	2	7	5	35	PCR	Creative Play	
PBC	0	2	5	0	1	8	PBC	Building/Construction	
PMI	3	2	2	2	3	12	PMI	Mutual Interest	
PED	0	6	1	4	0	11	PED	Education	
PPHY	1	0	0	2	0	3	PPHY	Physical Play	
PCHI	1	0	3	0	0	4	PCHI	Child to child play	
TIME							TIME		
TWS	1	3	3	2	5	14	TWS	Work Schedule	
TFT	2	4	0	1	0	7	TFT	Free Time	
TBU	2	1	1	0	1	5	TBU	Busy or Unavailable	
TM	1	0	2	0	7	10	TM	Morning	
TA	0	5	1	2	3	11	TA	Afternoon	
TW	1	7	2	0	3	13	TW	Weekends	
TWMT	0	3	0	0	0	3	TWMT	Wants More Time	
TWLT	1	1	0	0	0	2	TWLT	Wants Less Time	
TRMT	0	0	0	0	2	2	TRMT	Right Amount of Time	
ECD							ECD		
CDL	0	0	0	4	1	5	CDL	Little knowledge	
CDS	1	2	0	0	3	6	CDS	Some Knowledge	
CDH	0	0	1	0	0	1	CDH	High Knowledge	
CDRB	0	1	0	0	1	2	CDRB	Read Books	
CDSI	0	0	0	0	2	2	CDSI	Search Internet	
CDDO	0	1	0	0	1	2	CDDO	Discuss with others	
CDEA	0	0	0	0	2	2	CDEA	Easy to access	
CDHA	0	0	0	0	0	0	CDHA	Hard to Access	
CDFH	0	0	0	2	6	8	CDFH	Hard to Filter	
CDFA	0	0	0	0	2	2	CDFA	Focused Approach	
CDCA	2	0	1	3	9	15	CDCA	Casual Approach	
ACTIVITIES							ACTIVITIES		
AGR	3	4	4	2	5	18	AGR	General Routine	
ASI	0	0	0	4	3	7	ASI	Short Interactions	
ALI	0	1	0	5	13	19	ALI	Long Interactions	
AHA	1	4	3	1	3	12	AHA	Home Activities	
ANHA	1	7	2	4	9	23	ANHA	Non-home Activities	
AONO	0	1	0	1	1	3	AONO	One on One activities	
ADOM	1	2	0	0	0	3	ADOM	Domestic Activities	

Coding the interviews (see figure 13) showed that toys or artifacts were often used when playing or interacting with children. It was also discovered that creative play or activities were very frequent across all the interviews. Child-led play was common and as well as imitation or copy play activities. It showed that work commitments limited time spent with children, and the time that was available was either in the mornings, afternoons/night or on weekends. Most parents were happy with the amount of time they spent with their children and in some case would not mind them being a little more independent (child lead free play). All the parents had a casual approach to ECD and relied on their children to direct their development. This does not mean that effort was not made. Parents would actively read books and teach their children whenever the opportunity presented itself. Regarding activities, the most common themes related to general routines (getting ready, eating food, etc.). Long interactions (more than 30 minutes) were more common than short term interactions (less than 30 minutes) and in most cases there was a focus on participating in activities outside of the home.

CULTURAL PROBE

At the conclusion of the interview participants were asked to take part in a cultural probe. The probe consisted of three tasks. The first was to record the amount of time each parent spent with their child/children over a seven-day period (see figure 14). The second required the participants to take photographs of play spaces in their home and the final task was to select and organise their children's toys into three categories: toys played with all the time; toys played with sometimes; and toy almost never played with. The data was collected in a follow up interview and coded for the three tasks.

The schedule/time spent with children was broken up into two categories: time spent doing everyday tasks such as feeding, bathing, dressing, etc; and quality time spent together. Overall parents were spent about 38 hours a week with their children (38.35). When broken down between parenting roles, fathers were spending about 33 hours a week while mothers were spending 43 hours a week. When it came to the difference between everyday tasks versus quality time, the average split was almost half (20 hours vs 18 hours). Time spent together on weekends (76 combined) was 65% higher than on weekdays (46 combined). Time spent with children greatly depended on work commitments and maternal requirements. In families where the mothers were still breast-feeding, time spent with children was much higher. Also, mothers were generally more involved in the bedtime routines, and often requested by children when requesting assistance or upset.

Figure 14 - Weekly Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Everyday Activity	1 hour	2 hours	1 hour	15 min	1 hour	3 hours	45 min
Quality Time	1 hour	2 hours	30 min	30 min	1 hour	4 hours	1.5 hours

In total there were nine play spaces recorded as part of the cultural probe. An example can be seen in figure 15. These were categorised into indoor/outdoor spaces and large/medium/small. Indoor spaces made up 5, with outdoor accounting for 4. Two of the spaces were large (backyards), three medium in size (deck and living room) and three were classed as small (living rooms and bedroom). The indoor spaces all had limited space and room for storage, but all included either a toy chest/box or a desk/shelves. The outdoor spaces had a lot more room for playing and storing, and usually included things like trampolines and craft/arts spaces. The participants that lived in a townhouse and apartment did not record any outdoor space, but both verbally confirmed having a balcony or courtyard space that was not really utilised.

The final task asked participants to categorise toys into the following: toys played with all the time; toys played with sometimes; and toy almost never played with. The data collected really varied between participants with no clear patterns or preferences when it came to toy popularity. In the most used category, arts and craft, block/building and imagination/role play were popular. In the sometimes-used category stuffed toys, musical toys and block/building toys were common. In the never used category the most common items included figurines and stuffed toys. However, these items could also be found in the other categories. When discussing this with the parents, it seemed that it really came down to personal preference and the children's tastes changing from week to week. Toys that they might be interested in one week could change to something completely different the next. Parents from interviews 1, 3 and 5 mentioned that toys that could change and grow with their child were better value for money. This could be correlated with why activities like arts and craft, LEGO and dress up or imagination play were popular options.

Figure 15 - Play space example





“we do try get a bit of play in every day... get your homework done and... then we’ve got time to play together”

Interview participant 3 - Mother, 2021

Image - (Ben Hermann, 2021)

Discussion &

A decorative pattern of light orange zigzag lines runs vertically along the left side of the page.

Recommendations for Design

DISCUSSION

Primary research showed that of the parents that completed questionnaire, participated in the interview and cultural probe activity, most of them were women (78%) and women were more likely to be active in researching ECD than men (see appendix 2.1.4). The vast majority of participants were in the late 30's or early 40's and would be the best demographic to cater for when designing possible products/services.

More than half of families had one child but having two children was almost as common (45.5%). Most children in the questionnaire fell between the ages of 2-6 years old, but this was expected due to the parameters set by questionnaire eligibility (see appendix 1.1). Location and income showed biases to people living in Brisbane, but did include participants from Melbourne and Sydney, as well as a small group of participants from Japan and England (see appendix 2.1.5). There was no distinguishable difference between Australian based participants and those based overseas, however, a larger data set would be required to determine if this had an impact on the results. Income brackets indicate that 70% of participants had a combined household income of \$100,000.00 or more (see appendix 2.1.6). This indicates some disposable income which was confirmed by the 62% of parents that purchased new toys once a month or every few months.

Early Childhood Development

The literature outlined the importance of play for ECD (Tom & Gisli, 2018, p. 32), and the primary research confirmed this, with almost all questionnaire participants strongly agreeing or agreeing that play was important to a child development (55 out of 56). The interviews showed that all parents spent considerable effort ensuring that their children had time each day to play either self-guided or with their parents' participation with a minimum of 1 hour per day recorded.

When it came to parents' knowledge regarding ECD, there was a divide between participants that had a high level of knowledge (interview participants 1 and 3) and those that used resources such as internet searches and books (interview participants 2, 4 and 5). But with all parents the general attitude towards ECD was casual and they relied on indicators from their children to determine if they needed to intervene. This casual approach meant that

there was little need or pressure for parents to seek out information relating to ECD outside of general interest or concern.

Challenges Faced

The literature outlined three reasons as to why parents lacked knowledge regarding ECD. This included lack access to information, too much information or conflicting information (Ayob, Christopher & Naidoo, 2021). The data collected in the questionnaires and interviews showed this not to be the case and that access was not an issue. Parents had access to information through internet searches, social media, books, and information discussed with family and friends and support groups. However, the point in the literature noting that there was too much information or conflicting information relating to ECD, was echoed by the participants. Being able to filter the information available was difficult and could be overwhelming for many parents (interview participants 2, 4 and 5).

The literature also showed that limited time was a factor for parents and prevented them from spending time with their children (Pencavel, 2018). Between work commitments and extracurricular activities both parents and children were predisposed and had little time to spend together. The primary research did not support this. Most parents surveyed and interviewed spent considerable time with their children each week and for the most part was satisfied with their time together. There were two cases during the interviews where parents were looking for ways to spend less time with their children, wanting artifacts and activities that could hold a child's attention for long periods of time parents (interview participants 1 and 5). There was a small percentage of parents that wanted to spend more time with their children (interview participants 2 and 5), but inflexible work commitments were the main cause for being unable to spend the time they wanted with their children.

While not identified in the literature, the primary research found a common desire of parents to share interests with their children (interview participants 1, 2 and 5). Many of the toys and activities that were enjoyed by parents resulted from them having a higher interest in the product or activity. This desire to find a common ground was shared by several the participants that were interviewed (interview participants 1, 3 and 5). Children often wanted to include their parents in play and activities, but parents admitted that unless they also had

an interest in the play/activity then maintaining their interest was difficult. One example of this is with the couples that participated in the second interview. The parents and children shared equal desire to play with LEGO and this was a common activity in the home (interview participant 2). This also influenced a parent's toy purchasing decisions, influencing the types of toys they would purchase.

Toy Preferences

Toys and children's preferences were recorded during the questionnaire, interviews, and cultural probes. In the questionnaire parents were asked to list their child's favourite toys, before being asked to list what toy, of their child's, was their favorite. The toys were then organised into several categories (see appendix 2.1.8). The number of toys in each category tallied and compared between the children's and parents' favorite toys. Children preferred dolls, figurines, and animals accounting for 30% of the data. The second most popular toys were from the brick/building category at 20%, closely followed by outdoor/sports (15%) and toy vehicles (14%). However, when it came to parents their preference for their children's toys were brick/building at 27%, dolls/figurines at 22%, then followed by outdoor/sports (20%) and toy vehicles (13%). Whilst the results were similar parents preferred block/building based toys, such as LEGO, over the dolls, figurines and animals' category that were preferred by the children (see figure 16). Combining the children's and parents' preferences block/build based toys made up almost 40% of preferred toys. And LEGO made up the highest percentage of individual toys accounting for 14% of all toys mentioned.

The interview and cultural probes presented a slightly different observation with arts and crafts, Play-Doh, dress up, games and puzzles all being referenced as play activities that were most popular with their children, but again LEGO and figurines/animals were mentioned several times as being extremely popular toys (see appendix 4.2.2). The family from interview 2 were particularly keen on LEGO and held regular build challenges and had an entire section of their living room dedicated to storing LEGO.

The literature noted that toys should be designed with both the children and parents in mind (Page & Thorsteinsson, 2017). In 'Designing Toys and Play Activities for the Development of Social Skills in Childhood' the writers talked about how brick-based toys focus on building and cooperation play, which helps to build social skills, and problem solving, which helps with a child's development (Page & Thorsteinsson, 2017). This literature around designing toys that appealed to parents as well as children said that parents needed a benefit or positive outcome to help justify a purchase and adding education benefits was a successful way of achieving this. In the interviews this was confirmed by the parents (interview participants 2, 3 and 5). Whilst education was not usually the driving force around purchasing toys, it could often influence a purchasing decision and help to preference one toy over another.

Constructive play is one of the five play categories (Hurwitz, 2002) and considered important to childhood development. Designing a product based around constructive play, would provide developmental and educational benefits to a child, and at the same time appeal to parents.

Figure 16 - Toy Preference

Children	C%	Parents	P%
Doll & Figurine	30	Build/Construct	27
Build/Construct	20	Dolls, Figures, etc.	22
Outdoor or Sports	15	Outdoor or Sports	20
Vehicles	14	Vehicles	13
Miscellaneous	9	Books	8
Books	8	Miscellaneous	8
Imaginative/Role Play	4	Imaginative/Role Play	2

Limitations

Research for this report included 56 questionnaire participants, five 30-minute interviews that involved 9 parents, and five cultural probes that were completed by the interview participants. Whilst this is a good sample size, a larger data set could provide greater insights into parent and child interactions, toys preferences and knowledge of ECD.

Most of the participants that took part in this research were based in Brisbane, Australia. There were participants from Melbourne and Sydney, as well as Japan and England, however this only accounted for a small percentage of respondents.

There is possibly an age bias in these results based on the method in which the questionnaires and interviews were distributed. Participants were recruited amongst existing social and parenting groups that the researcher was already involved in. Whilst these groups were not age exclusive many of the members of these groups are of a similar age to the researcher. According to the Australian Institute of Health and Welfare, the average age for first time parenthood is now 29.3 (Australian Institute of Health and Welfare, 2020), so the data could be accurate but could also be bias.

All the primary research conducted for this report was done with parents and not done directly with children. The children's perspective was always interpreted through their parents. Some of the cultural probe activities included child involvement (i.e., asking a child to select their favourite toys), however there is no way of knowing if this was the case or if the activity was completed by the parent.

Addressing the gap

In the literature a number of themes were identified that could be further investigated, however, to help better understand the topics relating to this research we focused on the following:

- What interacts and activities do parents currently enjoy?
- What toys or artefacts do children and parents use?
- How can time between a parent and child be more engaging?
- Is there a need to provide parents with knowledge relating to ECD?

The questionnaires, interviews and cultural probe provided insights into the time parents spent with their children and what activities they enjoyed doing together. The participants that completed the cultural probe were spending between 12 and 29 hours a week having what they considered quality time together (see appendix 4.2.1). In the questionnaire parents were asked to provide their favored game or activity (question 23). The results showed that outdoor activities such as playing hide & seek, visiting a park/playground, cycling and general backyard play were the most popular activity. This was followed by arts & creativity activities, role play & dress ups, and dancing & singing as the most popular activities. During interview 1, 2 and 5, parents talked about time spent with their children and how there was a desire to share a common interest. If parents were interested in an activity that their child was doing, then they were more likely to want to be involved.

The questionnaire addresses the question around what toys children preferred, and by asking what toys or artifacts parents also liked we were able to determine the types of toys that both parents and children liked. Whilst the most popular type of toys differs between the two groups, the three most popular categories were the same. This included brick/building, dolls/figurines, and outdoor/sports related toys.

Three fathers in interviews 1, 2 and 3 expressed a desire to find something that they enjoyed that they could share with their children. Four of mothers interviewed (interviews 1, 2, 3, and 5) discussed activities that they did with their children that were cooperative and this made the activity more enjoyable and engaging. These included playing with LEGO, cooking together, riding a bike or scooter to a park. The key to making the most of the time together is to find a common activity that both the parents and child enjoy doing.

The interviews and questionnaires results indicated that parents were able to access information relating to ECD easily and were not desiring more information. The casual approach to ECD and rising children was shared across all participants of the interviews. In interviews 3 and 5 parents express and desire or need to filter the information that was available. The overwhelming amount of information and conflicting information made it difficult to know what was best for their child. When designing a product providing clear information relating to the benefits the product could provide to a child and how it will help with their development is important, but this information also needs to be backed up with evidence (sources) so that a parent can make an informed decision.

RECOMMENDATIONS

This report has identified several opportunities that can be address through design. To improve interactions between children and their parents and carers through play.

- Product/Service should grow with the child to increase longevity and provide value for customer value (interviews 3 and 5 and questionnaire question 12)
- Focus on constructive play style, with a secondary focus on practice, role-play and pretend play (Hurwitz, 2002).
- The inclusion of problem-solving play combined with cooperative play helps child development and social skills (Gleave & Cole-Hamilton, 2012).
- Play activities based on block and building were the most popular activities for both parent and children. There should be a focus on these types of toys, but can also include art & creative, and role-play elements (questionnaire question 10 & 11).
- To improve parents' participation in play activities there should be a focus on designing toys/activities with cooperative play and a shared interest between parents and children (interviews 1, 2, and 5).
- A product needs to clearly state the ECD benefits it provides to a child and where this information/research came from to help parents make an informed purchasing decision (interviews 1, 2, and 5).
- A product that can be used both indoors and outdoors provides greater verticality to the user (questionnaire question 23 and interviews 1, 2, 3, and 5).

Proposals & Concepts



DESIGN INTENT

Aim

To develop a product or system that encourages developmental play for children between the ages of 3 and 8 years old, while focusing on cooperative, constructive and imaginative play that facilitates common interests shared by parents/carers.

Objectives

The aim is to create a product or system that encourages play for preschool children, whilst providing them with key developmentally opportunities such as constructive play; role play; and practice play. There is also a focus on cooperative play, that includes parents/carers which can lead to meaningful interactions further contributing to social and language development. The product/system will need to grow with the child taking them from early preschool age through until early elementary school age (3 to 8 years old).

To engage the parent/carer, the product/system also needs to foster a shared interest that is common between the child and parent/carer. This will be done by either integrating outdoor or arts and crafts activities that were found to be the most popular activities by the participants of this research.

Play is important to children's development, and this is supported by the literature and primary research. Parents and carers play a large role in the development of these skills, and how their interactions with their children can have positive influences. Play is recognised as a key factor in how children learn and explore. It helps them understand the world around them and build important problem-solving skills.

Context

The solution will primarily be used in the home or backyard, however as identified through the primary research could also be used outdoors in spaces such as playgrounds, parks and public spaces.

The product/system will also need to fit within existing play spaces. This includes apartments, town houses and single dwelling homes. It will need to be stored within these spaces and consideration on how the product/system is stored and where it is stored will need to be accounted for.

People

Children – Pre-school age, 3-8 years old. 1 (50%) or 2 (45%) children per household.

Parents – 34-44 years old, based in Australia (Brisbane), median income bracket. Disposable income. Purchase toys once a month, every few months (62%) or greater.

Justification

The importance of ECD is well documented and the benefits of teaching children the basic building blocks of important life skills provide them with the best chance to succeed in life (Shonkoff & Phillips, 2000). Parents play a large role in the development of these skills and how they interact with their children can have both positive and negative influences. Play is recognised as a key factor in how children learn and explore. It helps them understand the world around them and build important problem-solving skills (Gleave & Cole-Hamilton, 2012).

By providing children with quality learning opportunities, cognitive development, mental health, and social behaviour skills can be improved (UNICEF et al., 2018). There are different types of play that help develop different aspects of a child's developmental needs. Practise play, constructive play, role play, pretend play, and fun play all work together to give children the best chance to succeed (Hurwitz, 2002).

Research conducted in this report showed that parents have time to spend with their children (at least 1 hour per day) but want to make the most of that time. Parents are also looking for a shared interest or common interest. Children wanted to include their parents in play, but parents found it hard to maintain interest if the activity was something that they did not enjoy. Construction activities such as LOGO were most popular, but so was outdoor activities.

This research found that crafts, Play-Doh, dressing up, games and puzzles were cited as children's most popular play activities, but LEGO was also mentioned several times as extremely popular, along with dolls/figurines and outdoor/sports.

Parents on a whole had a casual approach to ECD, but had trouble filtering the ECD information that was available. In order for parents to make a purchasing decision, a product must clearly outline the ECD benefits and provide supporting proof/evidence..

The goal is to create an environment that encourages pre-schoolers to play while providing them with important developmental opportunities such as constructive play, role play, and practice play. Emphasis is also placed on cooperative play that involves parents/ caregivers, which can lead to meaningful interactions that further contribute to social and language development. The product/system must grow with the child and accompany them from early preschool to early elementary school age (3 to 8 years).

Key Criteria

	Key Criteria	Reference
Utility and Function	<ul style="list-style-type: none"> • Provide opportunities for developmental growth and learning by focusing on constructive play with a secondary focus on practice, role-play, and pretend play • Facilitate interaction and cooperation between a child and their parents or other siblings/children. • Encourage play and hold the interest of children and parents over an extended period. By providing challenges or goals. • Possibly include creative or artistic elements to encourage abstract thinking. • Balance the needs of both consumers. The child who will play with the product/system and offer educational benefits to convince parents to make the initial purchase. • The product/system needs to hold the interest of the child and met different developmental stages as they get older. • Possibly be used both indoors and outdoors provides greater verticality to the users. 	<p>Questionnaire Questions 2, 8, 13-20 & 23</p> <p>Interviews Interviews 1, 2, 3, and 5</p> <p>Literature Review Hurwitz, 2002 Hughes, 1999 Gleave & Cole-Hamilton, 2012</p>
Materials	<ul style="list-style-type: none"> • Non-toxic child safe materials. • Avoid overusing plastics and try and use more natural materials such as wood or cloth. • Consider the impact that making these products has on places where children live and the environment, society and economy that will support them in the future. 	<p>Questionnaire Question 20</p> <p>Interviews Interviews 2, 3, and 4</p> <p>Literature Review Edward, 2010</p>
Aesthetics	<ul style="list-style-type: none"> • Avoid gender stereotypes and traditional boys/girls colours i.e. blue / pink aisle. • Design and aesthetics are important to the user. Form needs to appeal to the secondary user (parents). • Product/system needs to include some level of novelty or elements of fun. 	<p>Questionnaire Question 17</p> <p>Interviews Interview 2, 3, and 5</p> <p>Cultural Probe Probe 2, 3 and 5</p>

	Key Criteria	Reference
Ergonomics	<ul style="list-style-type: none"> • Allow for children ages 3- 8 years old to use and operate safely. • Consider human factors through the application of psychological and physiological principles to design product that can be used by children (3-8 years old) and operated by parents/carers (largest age range possible). • Must be able to fit within a home, including apartments, townhouses and single dwellings 	<p>Questionnaire Question 12</p> <p>Literature Review Fishel, 2001 Page & Thorsteinsson, 2017</p>
Developmental Focus	<ul style="list-style-type: none"> • Encourage the development or problem-solving skills through trial and error. • Focus on spatial development and object manipulation through guided interaction with their parents/carers. • Design activities that encourage guided interactions so that children can learn and explore without becoming frustrated. • Encourage children to cooperate with parents/carers and peers which helps build social and language skills. • Incorporate opportunities for make believe-play and pretend play to assist in developing creativity and abstract thinking. • Include at least two play development classification themes; conditional play; constructive play; role play; and practice play. 	<p>Literature Review Dansky & Silverman, 1975 Holmes & Romeo, 2018 Brown & Prescott, 1997 Wood & Bruner, 2016</p>
Lifecycle	<ul style="list-style-type: none"> • Should be able to last 5 – 10 years as it is used by a child and possibly their sibling. • Can adapt to the needs of the user allowing for continued use over the lifecycle of the product. • Constructed of recycleable and reusable materials. 	<p>Questionnaire Question 19</p> <p>Interviews Interviews 1, 2, 3 and 4</p>
Safety	<ul style="list-style-type: none"> • Must comply with Australian/New Zealand Standard (AS/NZS) ISO 8124.1: ‘Safety Aspects Related to Mechanical and Physical Properties.’ • Including but not limited to: <ul style="list-style-type: none"> • Small parts testing (AS/NZS ISO 8124.1 -- 5.2) • Testing for shape and size (5.3) • The security of small battery compartments (A2.3) 	<p>Australian Competition & Consumer Commission (ACCC)</p>
Maintenance & Support	<ul style="list-style-type: none"> • Access to user replaceable parts or components if something breaks or is lost. • Easy to read clear instructions that are available online so that they can be referred to after the initial purchase. 	<p>Interviews Interviews 2, 3 and 4</p>

CONCEPT ONE

Description

Focusing on the constructive play developmental categories, this concept is made up of several blocks, shapes and pieces that can be stacked into unlimited structures. There are a couple of main ways this concept can be used. The first is a game, like “Jenga”, children and parents take turns placing one piece at a time building up the structure. The aim is to build it as high as possible without it falling over. Parents and children will need to work together to balance the pieces. As the structure gets higher, parents will need to assist their children to reach the top of the structure. The second is building structures for imaginative and role-play. A child and parent can build one or multiple structures and use the figurines, vehicles and toys they already have to create towns, worlds and universes that they can explore and play in.

The concept is made up of multiple shapes, colours and designs that provided opportunities for learning. Counting, colours and materials can all be taught by parents while playing with the product.

Key Features and Functions

- Focus on constructive play with possibilities for role-play and imagination.
- Cooperation between child and parents by taking turns and stacking the pieces to build up the structure.
- Focus on problem solving skills and trial and error.
- As the child gets older the system can be used in different ways with different learning outcomes, colours, counting, etc.
- Can be used indoors and outdoors.
- Made from child safe natural materials and non-toxic paints.
- Made locally to reduce environmental impact and recyclable.
- Suitable for all children (non-gender specific).
- Can be packed away in storage box or toy chest.
- Encourages parents to interact and assist.
- Long lasting and durable.

Limitations and Constraints

- Takes up a lot of space and not all dwellings will have the space to store.
- May have limited learning or developmental opportunities.
- Some parts may need to be made out of plastic or similar materials to reduce manufacturing cost.

Australian and International Standards

- AS ISO 10377:2017 - Consumer product safety
- AS/NZS ISO 8124.1 -- 5.2 - Small parts testing

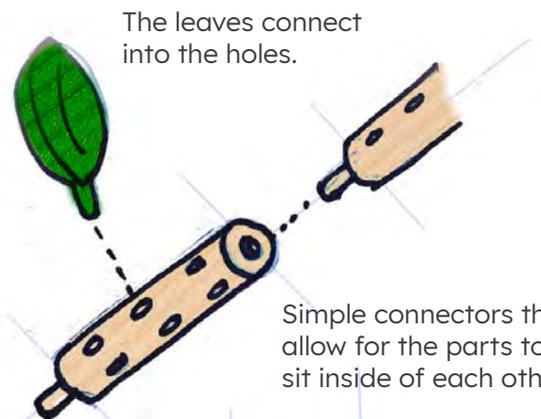
Tower Stacker - Constructive Play

The aim is to build it as high as possible without it falling over. Parents and children will need to work together to balance the pieces.



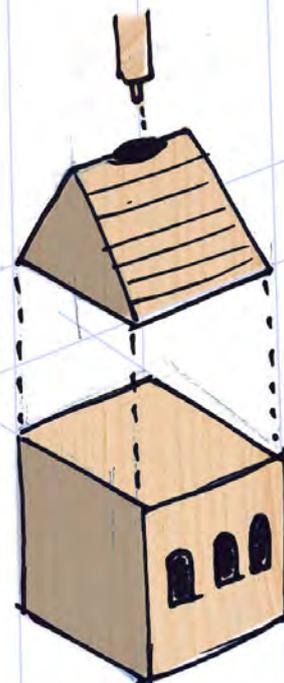
Large structures can be built that encourage imagination and role play. Allow for other toys to be utilised for storytelling and fun.

Natural materials.



The leaves connect into the holes.

Simple connectors that allow for the parts to sit inside of each other.



Block simply stack on top of each other and come in various shapes and sizes.

CONCEPT TWO

Description

Providing a lot of verticality this concept focuses on constructive play and problem solving, but also encourages indoor/outdoor activities and exercise. Users are presented with a collection of various parts, shapes and devices that can be built into various products. Using the parts in the kit, children and parents work together to build a balance board, for developing motor skill and balance, shopping cart for playing indoors and with their other toys or a scooter that then can ride at the local park with their parents. The parts are designed in such a way that there are an unlimited number of toys that can be made, either by using the instructions provided or inventing their own.

Each piece of the system is connected using a simple to use tri-wing screw and nut. As the child grows so can the types of toys they build. You can start off small and make a small vehicle that can be played with in the living room, or as they get older a balance bike for trips to the playground. Made locally from wood, combined with injection moulded connectors the product can be easily packed away when not in use and parts replaced individually if lost or damaged.

Key Features and Functions

- Focus on constructive play with possibilities for role-play and outdoor activity.
- Cooperation between child and parents through building the different toys.
- Focus on problem solving skills and trial and error.
- As the child gets older the system can be used in different ways build a balance bike when younger and then a scooter when they get older.
- Can be used indoors and outdoors. Shopping trolley indoors. Scooter outdoors.
- Made from child safe natural materials and non-toxic paints.
- Made locally to reduce environmental impact and recyclable.
- Suitable for all children (non-gender specific).
- Can be packed away in storage box or toy chest.
- Encourages parents to interact and assist in the building.
- Encourages outdoor activities and visits to parks/playgrounds.
- Long lasting and durable.

Limitations and Constraints

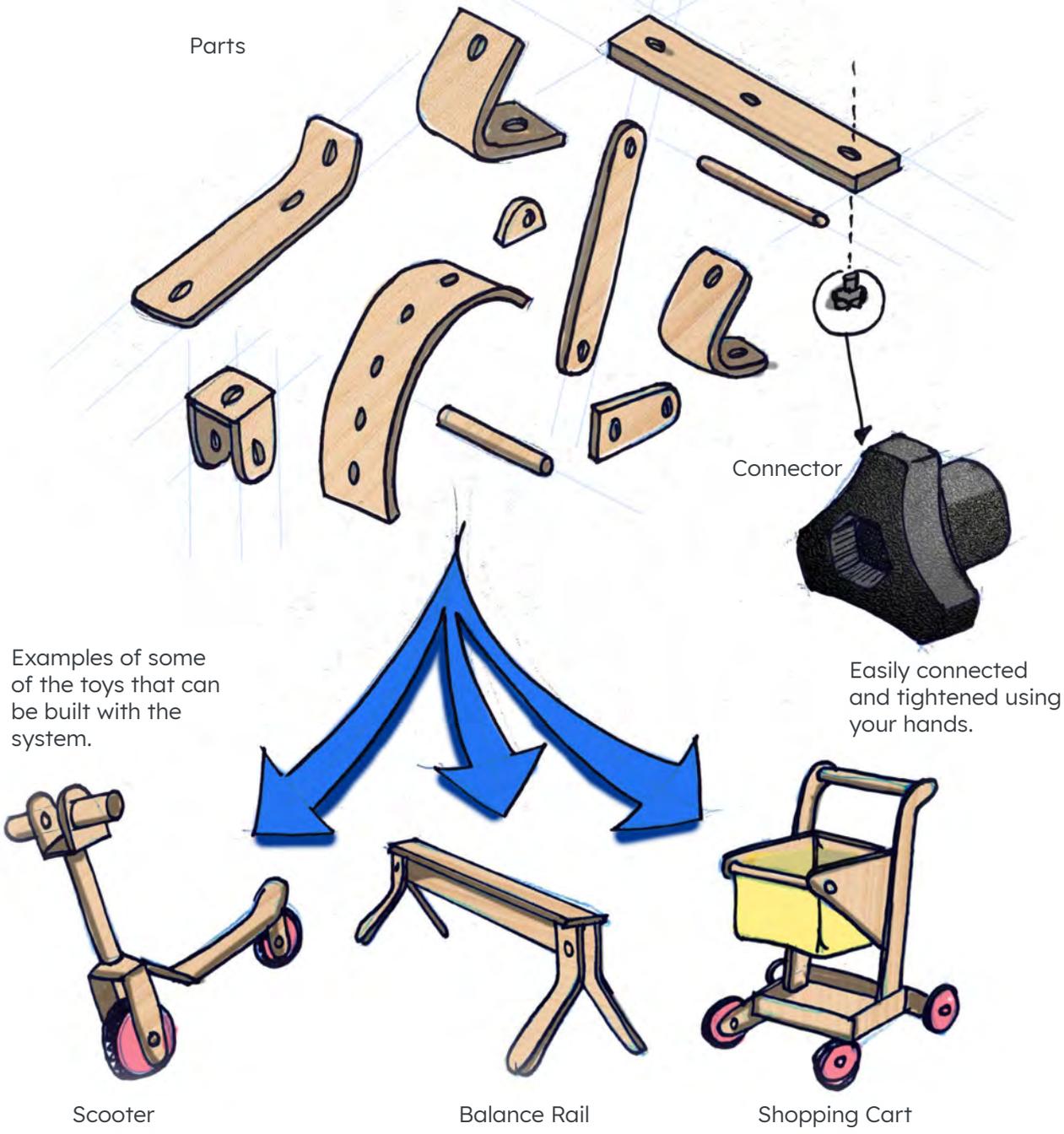
- May be too complex for younger children.
- No creative or artistic features.
- Contains some plastic parts.
- Can take up a lot of space making it difficult to store in smaller homes.

Australian and International Standards

- AS ISO 10377:2017 - Consumer product safety
- AS/NZS ISO 8124.1 -- 5.2 - Small parts testing

Open Ended - Constructive Play

Users are presented with a collection of various parts, shapes and devices that can be built into a number of products.



Parts

Connector

Examples of some of the toys that can be built with the system.

Easily connected and tightened using your hands.

Scooter

Balance Rail

Shopping Cart

CONCEPT THREE

Description

With a high focus on learning and games this concept is designed to engage children and parent to play, but also learn. The dodecagon shaped ball has twelve removable cards that can be changed by the parent. These cards can be of colours, shapes animals or custom-made cards that can be printed or drawing by the parents and children. This can be used as a learning tools for parents to teach new vocabulary. A parent also has the option to record their voice for each of the cards. This helps the child to hear a familiar vice when learning.

These are several games build into the device including, playing catch, Simon says, and memory. The ball also has a hide and seek game, where the parent or child will hide the ball around the house or backyard. Once hidden everyone starts looking for the ball. The ball will start to “glow” over time and eventually make a sound or noise to assist children finding it.

The ball contains several technologies, including a speaker, microphone, LED lights and motion sensors. As a child grow the cards can be changes out to keep inline with the learning milestones a parent wants to achieve. There are opportunities of arts and craft with children designing their own cards, and fun recording their own voices.

Key Features and Functions

- Focus on practice play with possibilities for problem solving and outdoor activity.
- Cooperation between child and parents through several games built into the device.
- Focus on problem solving skills and learning. .
- As the child gets older the system can be changes to make the difficulty harder and customised to the needs of the child.
- Can be used indoors and outdoors.
- Made from child safe natural non-toxic plastics.
- Suitable for all children (non-gender specific).
- Small and can fit into any dwelling.
- Encourages parents to interact and assist in learning and teaching their children.
- Uses the parents voice (recordings) to teach.
- Encourages outdoor activities and visits to parks/playgrounds.
- Long lasting and durable.

Limitations and Constraints

- Does not have any constructive play elements.
- Technology and electronics will increase the cost of manufacturing.
- Potential to be damaged easily.
- Design may be too complex.

Australian and International Standards

- AS ISO 10377:2017 - Consumer product safety
- AS/NZS 60335.2.29:2017 - Electrical appliances – Safety
- SO/IEC 21823-1:2019 – Internet of Things
- IEC TR 63071:2016 - Power supplying

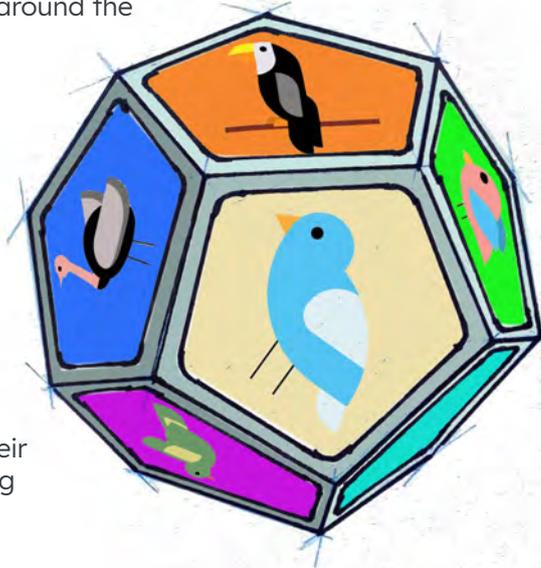
Art and Learning - Social Play

These are several games build into the device including, playing catch, Simon says, and memory. The ball also has a hide and seek game, where the parent or child will hide the ball around the house or backyard.

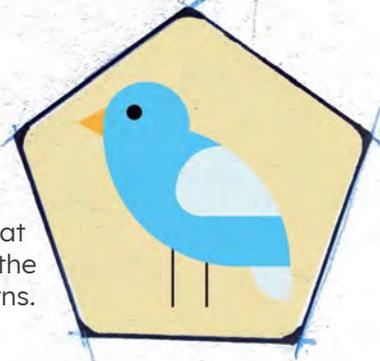
Technology

- LED Lights
- Microphone
- Speaker
- Motion Sensors

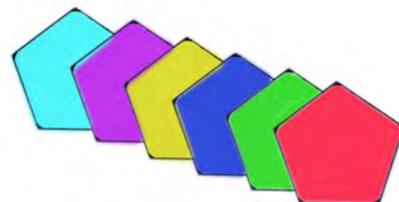
Parents can record their voice when introducing new vocabulary.



Removable cards that can be changed as the child grows and learns.



Small compact size easy for small hands to hold.



Colour Cards

Design Justification





INTRODUCTION

The benefits of early childhood development (ECD) has been well documented and forms the basis for a child's success in life. Parents are a huge part of ECD and their interactions with their children can have a huge impact on their development. Kids learn and explore through play. It helps them understand the world around them and develop important social and problem-solving skills.

The aim of the research is to develop a product or system that promotes developmental play for children between 3 and 8 years of age, while focusing on cooperative, constructive, imaginative play with a focus on shared interests between parents and children.

Our research has identified several opportunities that can be addressed through design. The goal is to improve interaction between children and their parents/caregivers.

The goal of the solution is to:

- Parents/ caregivers wanted to play with their children, but often struggled to find activities they enjoyed doing together.
- The most enjoyed activities shared between parent/ caregivers and their children included – construction-based play, outside/outdoor and arts & crafts-based activities.
- Parents/ caregivers wanted systems that were open ended, could grow with the child and were gender neutral.
- The solution should encourage cooperation, problem solving and play flexibility, but also provide opportunities for self-directed play when appropriate.

THE SŌZŌ PLAY SYSTEM

The SōZō Play system is a flexible modular system that allows for parents/caregivers to co-operate in building different play structures, modify them using everyday items from around the home and play with their creations either in their home or outdoors.

It is made up of various size blocks that can be joined using pins, straps and accessories such as wheels, hoses, and handles. When combined, these parts can be made to build (but not limited to) climbing blocks, ride-on car, balance board, toy house or tower. These items can be further customised using the unique SōZō pin and nut system to connect cardboard boxes or other common household items.

The system is designed with a level of complexity that requires parental assistance during the build/construction phase but allows for a child to continue to play with the item once build.

The system addresses the key criteria outlined on page 42.





Image - (Ben Hermann, 2021)

SEQUENCE OF USE



1 Parent/caregiver purchases the product



2 Parent/caregiver and child work together to make something (start by using the build guide)



3 Develop problem solving skills



4 Build can be customised using common household items



6 Child may require assistance to change or modify the build

5 Child and parent play together (home or outdoors)



7 Build can be deconstructed to build other things as required

Image - (Ben Hermann, 2021)

PACT ANALYSIS

People

Children – Pre-school age, 3-8 years old. 1 (50%) or 2 (45%) children per household.

Parents – 34-44 years old, based in Australia (Brisbane), median income bracket. Disposable income. Purchase toys once a month, every few months (62%) or greater.

Actions

Users' behaviour can be broken down into several situations. As discussed in the literature review section of this report, play can be categorised into four main learning interactions:

Free play - child-lead play where the child directs the activities.

Guided play – Child-led but with adult scaffolding. A parent/caregiver provides direction and can intervene to help prevent the child from becoming frustrated.

Games – Adults designed/scaffolded. Set rules and constraints for how a game is played, but still requires understanding and input from a child.

Direct instruction – Adult designed controlled, set rules for an activity that is teaching a child skills.

The SōZō Play system is designed to support all these playful learning interactions by providing the tools and systems required to support free play, guided play, games, and direct instruction. However, the focus of this product is to provide opportunities for parents/caregivers and their parents to play together so there a higher focus on system that support this primary outcome.

Scenario 1

Mother help to make something the child saw/is interested in.

Scenario 2

Father help to repair something that they build last weekend but has now been damaged.

Scenario 3

A trip to the local park/playground.

Context

The SōZō Play system would primarily be used at home or in the backyard, however, it can also be used outdoors in areas such as playgrounds, parks, and public places as identified through the primary research.

As well as fitting into existing play spaces, the SōZō Play system can be stored within them. Consideration has been given to how the product/system will be stored and where. A built item is stored in play areas/bedrooms along with other toys, while unused or loose items can be combined to be easily stored out of the way or placed in the included accessories bag.

Due to the versatility of the product, it will also take to the place of several existing toy products freeing up space within a home.

Technologies

The SōZō Play system use typical materials found in children's toys. These include Ethylene-vinyl acetate (EVA Foam), Polypropylene (child safe plastic), Silicone Rubber, and Solid Birch Wood. The packaging, which is also part of the product, is made from recycled paper with a printed slipcover to that is easily removable.

The silicone rubber used a relatively new technique called 'siloxane equilibration', this allows for damaged silicone rubber to completely repaired itself when exposed to a heat source such as an oven. This prolongs the life of the product and allows for the user to repair small damages to the silicon if required.

The only parts that contain mixed materials are the EVA block. These blocks contain polypropylene screw inserts that are glued into place. Whilst EVA and polypropylene can be recycled, the inserts need to be removed first.

DESIGN PROCESS

The design process for this project was broken into four stages using 'the Double Diamond' model.

The first stage is to research, discover and collect as much information as possible about the problem and the issues surrounding the topic you are trying to address. During this stage I can look at the world in a fresh way, notice new things and gather insights.

The second stage I define the focus area and try to make sense of all the possibilities identified in the Discover phase. What are the most important areas that I can address and how is this possible?

The third stage is to develop as many solutions and ideas as possible. I am continually creating, prototyping, testing, and iterating. Through this stage I am helping to define my ideas and improve on my designs.

The final stage is where I take everything, that I have learnt throughout the first three stages and bring the project together. Delivering the final product, which includes the product, service/ system and how everything work together to make one cohesive solution.

For this project the entire design process was achieved in 15 weeks (second semester 2021) from July 26th through to November 12th. Several milestones were planned and achieved across the semester. A break down of each stage and the milestones achieved can be found in figure 17.

These stages may not be strictly adhered to due to the nature of iterative design; rather, they serve as a guide for keeping the overall process on track.

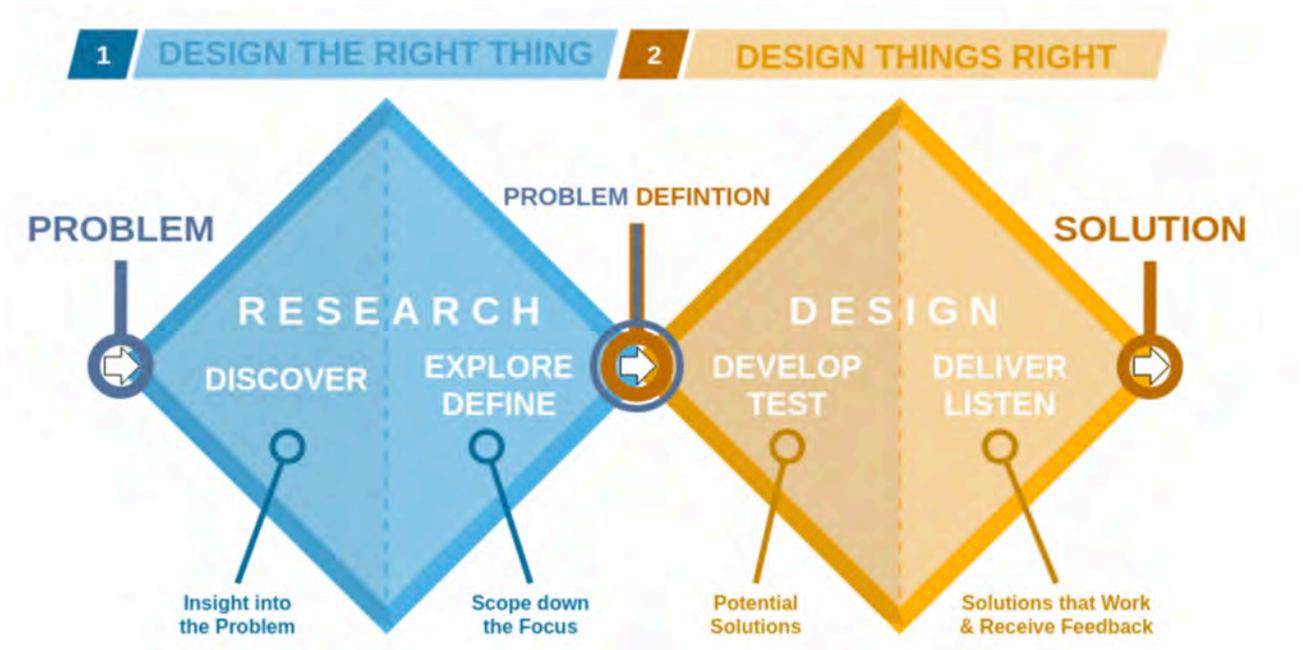


Illustration of the double diamond diagram - Digi-ark, 2020

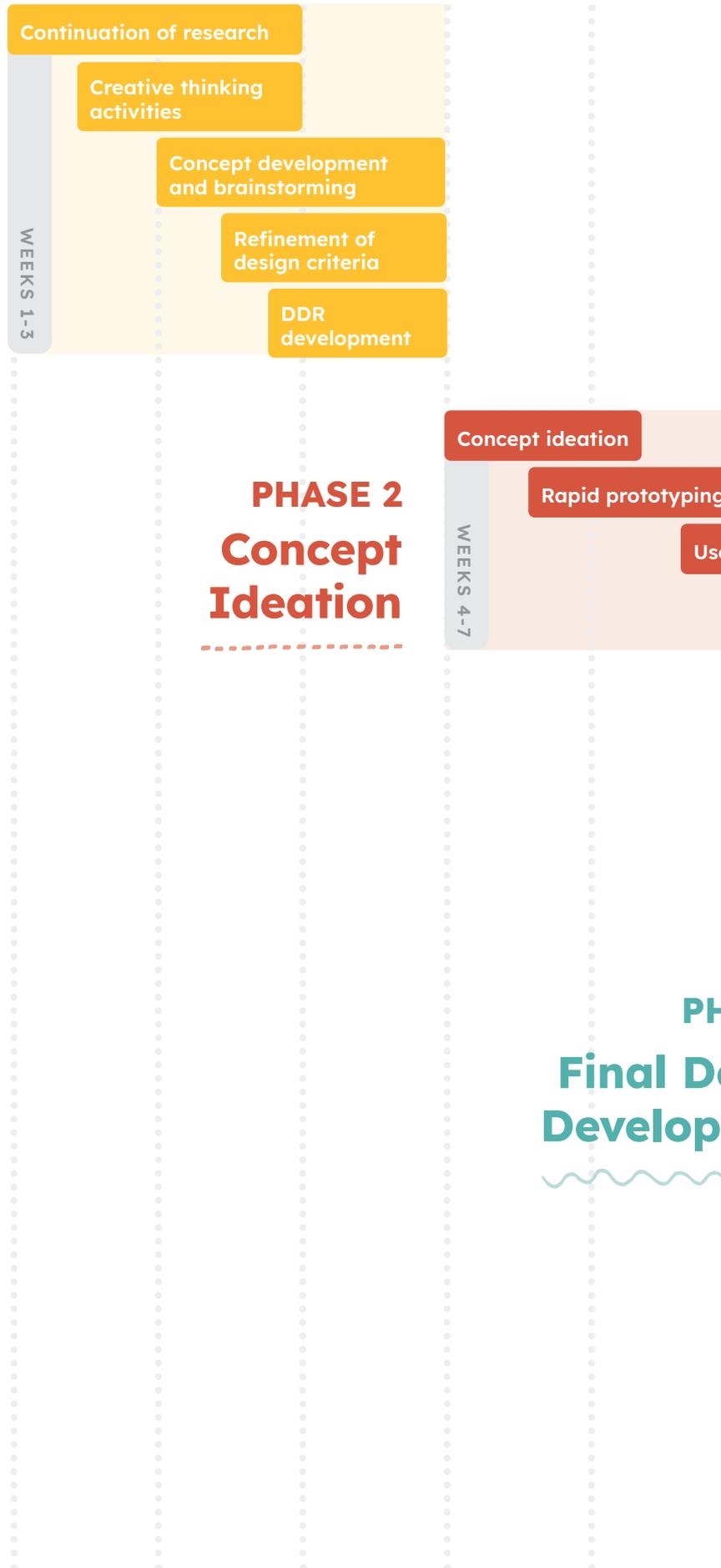


Image - (Ben Hermann, 2021)

Design Processes

PHASE 1 Creative Development

Figure 17 - Design Stage Milestones



er testing

er testing

Research and Development

Final Prototyping

Final testing

Manufacturing and material defined

Safety testing and compliance

Sustainability considerations

Preparation of final documents

CAD and Technical documentation

WEEKS 7-11

PHASE 3 Design ment

PHASE 4

Final Design Construction



Final prototype manufactured

WEEKS 11-13

Design documentation completed

Presentation design and content

FINAL SHOWCASE

Image - (Ben Hermann, 2021)

VALIDATION

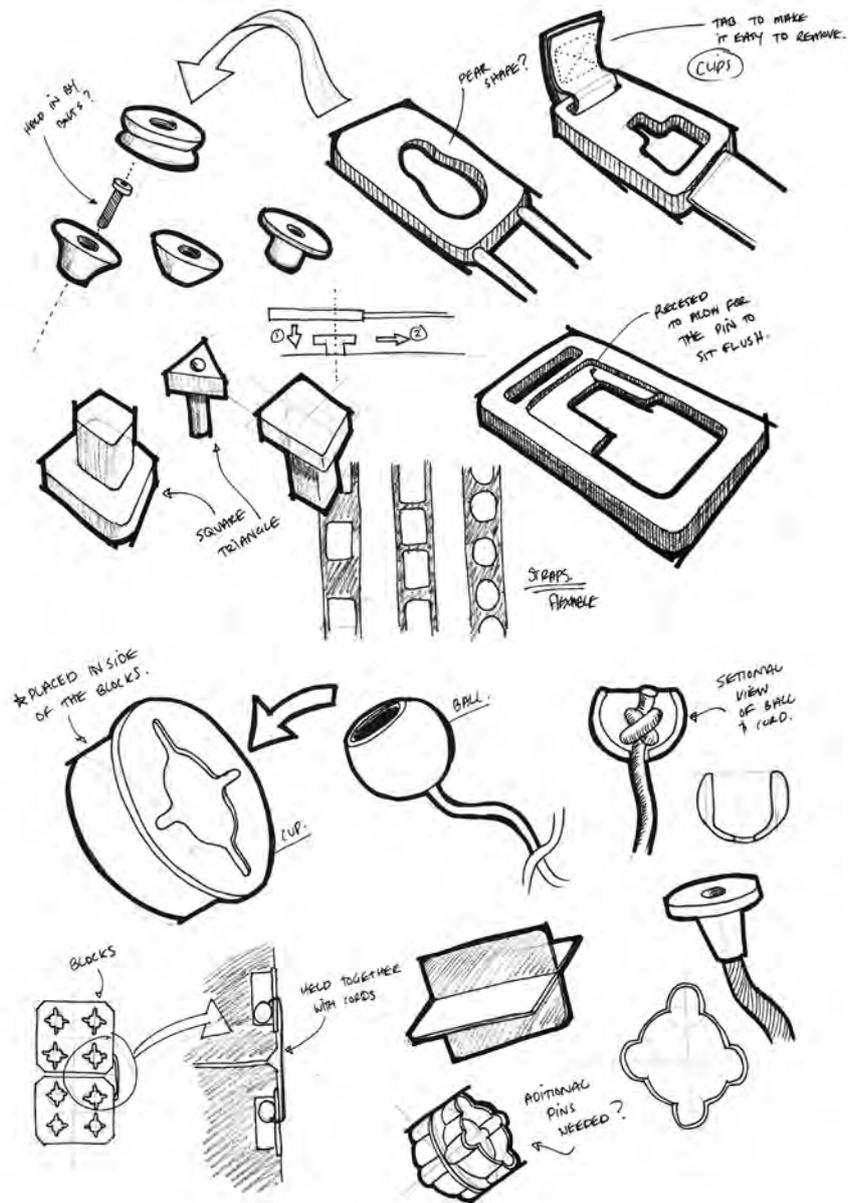
The validation process for the SōZō Play system was designed to test each individual design component in stages, with parts being combined at different developmental stage to observe how they interacted together. Each time a component was tested, feedback was recorded before changes were made to the design. Testing was conducted with target users (children) and parents/caregivers. Design changes were also discussed with peers and industrial design experts to determine the validity of the user data and to take into consideration the impact the changes would have on materials and manufacturing.

As each component went through a similar process in refining the design, an in-depth overview of design testing process for the SōZō Play bolt connector is shown below:

SōZō Play bolt connector:

Many connection methods were considered during the concept ideation phase (see figure 18). Initially concepts were presented in the form of drawings and discussed with users, peers, and industry experts. Based on these discussions, and number of low fidelity models were made and tested with users. Two systems were favoured and developed further.

Figure 18 – Joiner Exploration



Higher details concept models were produced (see figure 19) and again tested with users, peers, and industry experts. Based on some of the limitations of the strap system discovered during this testing phase it was decided that the bolt and nut system was the best option moving forward. This concept also provided an opportunity to connect artifacts outside to the intended design, which proved extremely favourable with parents/caregivers.

The original bolt included a round head, tight screw thread and multiple teeth. Users found the head too small, and the number of turns required to tighten the bolt difficult. There were also concerns that the cutting teeth might be dangerous.

An updated version with a larger head was produced and users found this to be more appropriately sized, but found grip was an issue.

A third concept model was produced incorporating a hexagonal head and greater spacing between the cutting teeth (see figure 20). Users reported that the head was much easier to grip and turn, but still expressed concerns about the teeth design.

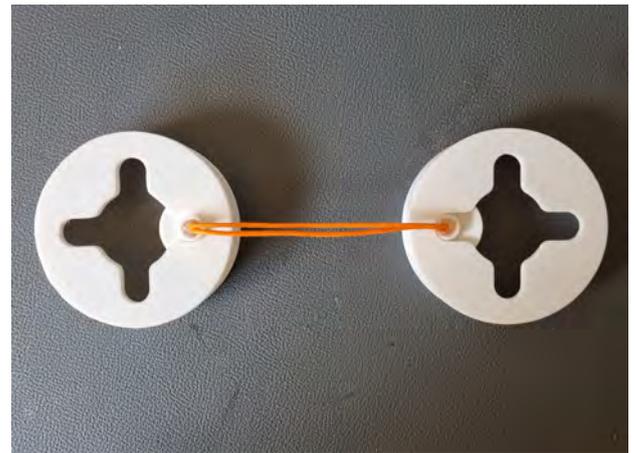


Figure 19 – First high detail concepts for testing with users



Figure 20 – The third concept model with hexagonal head.

Discussions with peers and industry experts helped to further refine the design, by adding indents into the hexagon for ergonomics (see figure 21). Anthropometric data was used to determine the size of these indents based on figure sizes of children within the target demographic and adults.

Further testing of the fourth concept was conducted with users (see figure 22) in combination with the block/insert system. This testing presented a new problem that haven't previously identified. Users were concerned with the hard edges on the bolt and the possibility of children injuring themselves should they run into the component.

During this testing several cutting teeth concepts were being tested and a successful (as in it could cut cardboard but not skin) design was finalised.

A fifth concept model was produced. This design included a rounded head, larger screw thread and the newly designed cutting teeth (see figure 23). This concept was tested with users and feedback was positive. A few minor changes were made to the design, mainly to include branding and considerations for manufacturing before the final model was manufactured.

A similar process for all components was followed and at various stages components combined to see how they interacted with each other.



Figure 21 – Concept 3 Vs concept 4 – Ergonomic considerations

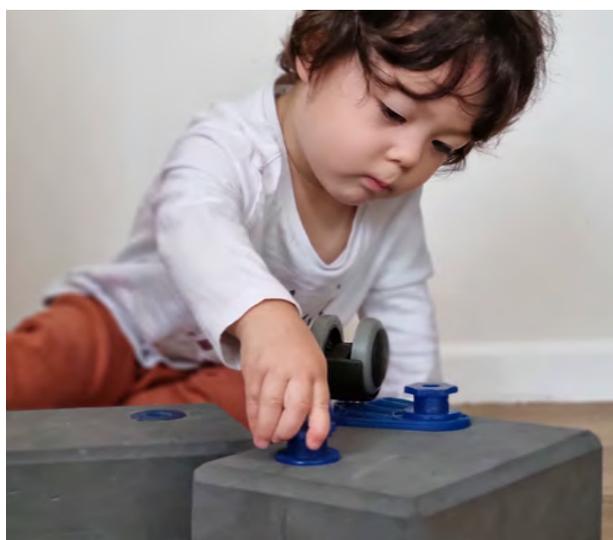


Figure 22 – User testing with concept 4



Figure 23 – The final design



BUSINESS CASE

Business Model Canvas

<p>Key Partners</p> <p>Manufacturers, Retailers, On-line partners</p>	<p>Key Activities</p> <p>Sales via retails and online store, Toy demonstrations in public spaces, online videos, and online promotion.</p>
<p>Key Resources</p> <p>Product, stores, website, employees (designers, logistics, marketing, etc).</p>	<p>Value Proposition</p> <p>Unique, flexible open-end play system. Can be used with other toys and products. Allows for upcycling and the use of items found around the house.</p>
<p>Customer Segments</p> <p>Kids (3-7 years old), parents/caregivers (20-50 years old), childcare centres, schools.</p>	



Image - (Ben Hermann, 2021)

SWOT ANALYSIS

Strengths



- Product Localisation
- Social initiatives
- Strong ability to add incentive and user motivation
- User adaptability
- Low Risk Start-up
- Safe and industry certified
- Ability to manage strategic change
- Well-developed corporate strategy
- Low impact implementation within sector

Weaknesses



- Performance depends on market trends
- Advertisement and marketing limitations
- Financial Resources
- Single industry focus
- Product development and sale time limitations due to low initial investment
- Reliance on 3 key staff members

Opportunities



- NPD from recycled materials
- International expansion
- Trial Version of product
- Product innovation
- Widen market selection
- Exploit unfulfilled customer needs

Threats



- Imitation of product and service
- Economic crisis/pandemic
- Increasing labour and resource costs



Image - (Ben Hermann, 2021)

Product Timeline

PRODUCT TIMELINE

9 Months

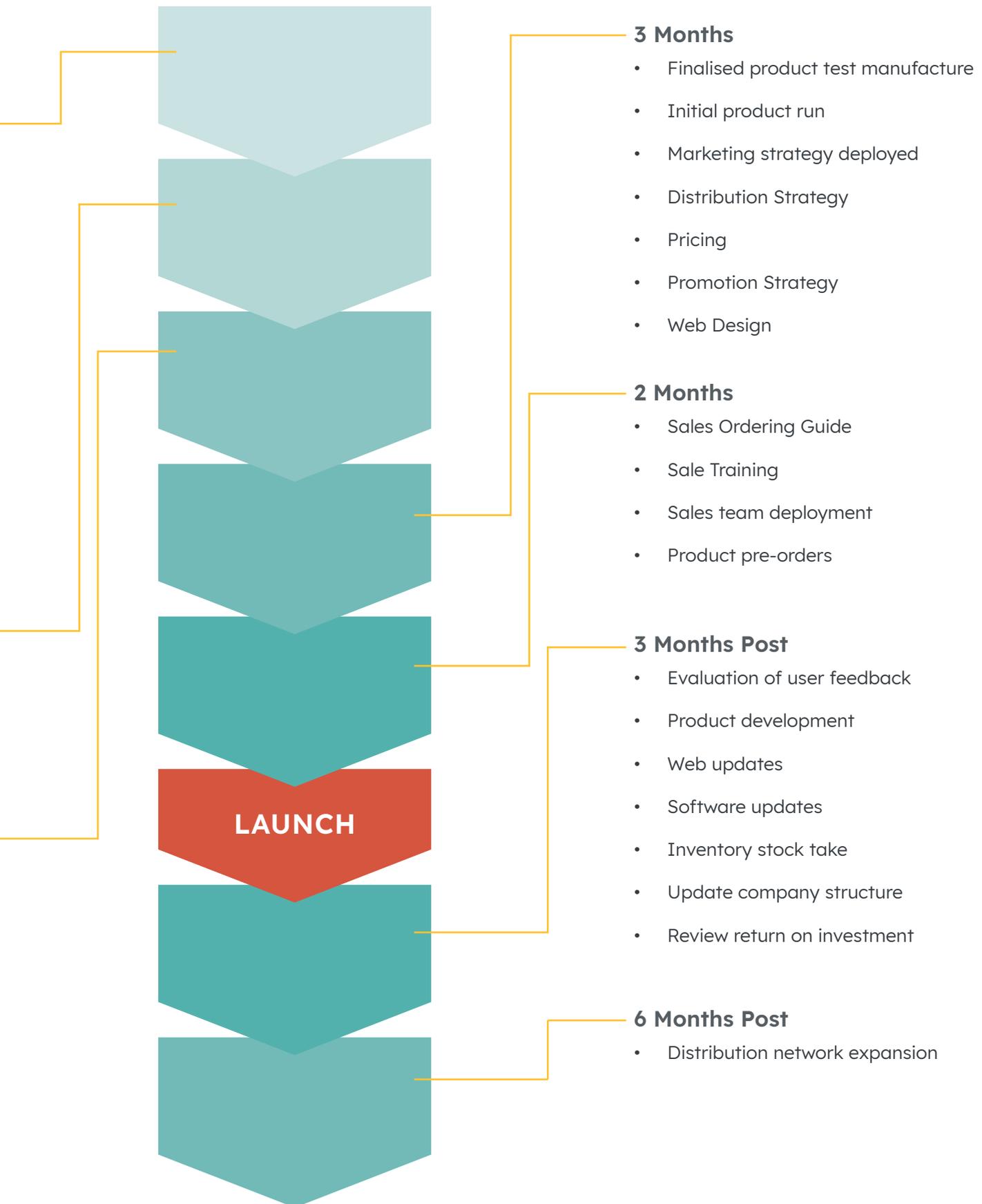
- Source Funding – Bank loan and angel investors
- Contact first user stake holders
- Develop user group
- Establish company structure
- Implement IP and legal strategies
- Understand safety standards
 - AS ISO 10377:2017 - Consumer product safety
 - AS/NZS ISO 8124.1 -- 5.2 – Small parts testing
- Establish manufacturing contacts
- Prototype product

7 Months

- Prototype product testing with users
- Test Manufacturing
- Initial safety testing

5 Months

- Final product testing with users
- Final safety testing:
 - Performance verification
 - Preventative maintenance



DESIGN DISCUSSION

Safety

As with any product designed for children, safety was a high concern with designing his product. The SōZō Play system has taken in several factors into account regarding safety. All materials selected are child safe and can be recycled. The bolt, nut and peg system has been designed with a breathing hole if one of the parts is placed in the mouth/throat. The blocks have been kept lite so that they don't cause injury to the users. All Australian and international standards have been followed including (but not limited to AS ISO 10377:2017 - Consumer product safety and AS/NZS ISO 8124.1 -- 5.2 - Small parts testing.

Manufacturing

Except for the block all parts and single piece in design, meaning that they don't need to be assembled and are ready to use straight off the production line. All materials are common within the manufacturing of children's toys and won't present any challenges to manufacturing partners.

By eliminating extra steps between the manufacturing process, single piece products save time and money when it comes to product handling and human interaction make for a more sufficient production.

Technology

The SōZō Play system uses typical materials found in children's toys, including EVA foam, polypropylene (child-safe plastic), silicone rubber, and solid Birch wood. Packaging, which is also part of the product, is made from recycled paper and has a printed slipcover that can be removed.

The EVA block is the only portion that has mixed materials. Polypropylene screw inserts are glued into place. The inserts must be removed before the EVA and polypropylene can be recycled.

The silicone rubber is made using a relatively new technology known as 'siloxane equilibration' which allows broken silicone rubber to entirely mend itself when subjected to heat, such as in an oven. This increases the product's lifespan and allows the user to fix minor damage to the parts.



Image - (Ben Hermann, 2021)

Aesthetics

The design aesthetics for this product were driven by the data collected during the research phase. Participants indicated that along with an open-ended product design, the product should remain gender neutral and avoid blue/pink gender stereotypes. It was also noted that the product should avoid 'rainbow' or excessive use of colours, instead a preference for neutral colours which allow for the users to add their own customisation was noted.

The SōZō Play system is made up of three main colours. This includes light grey (blocks), blue (connector system) and orange (connection straps). The large light grey blocks are intended to provide a neutral canvas, allowing for the users to add their own materials and colours to suit the build they are making. The blue and orange components are used to add colour to the design, but also used as signifiers to help the user understand the system. Blue bolts can be connected to blue inserts and nut. The Orange straps carry across the same round shape as the connectors indicating that they can be connected.

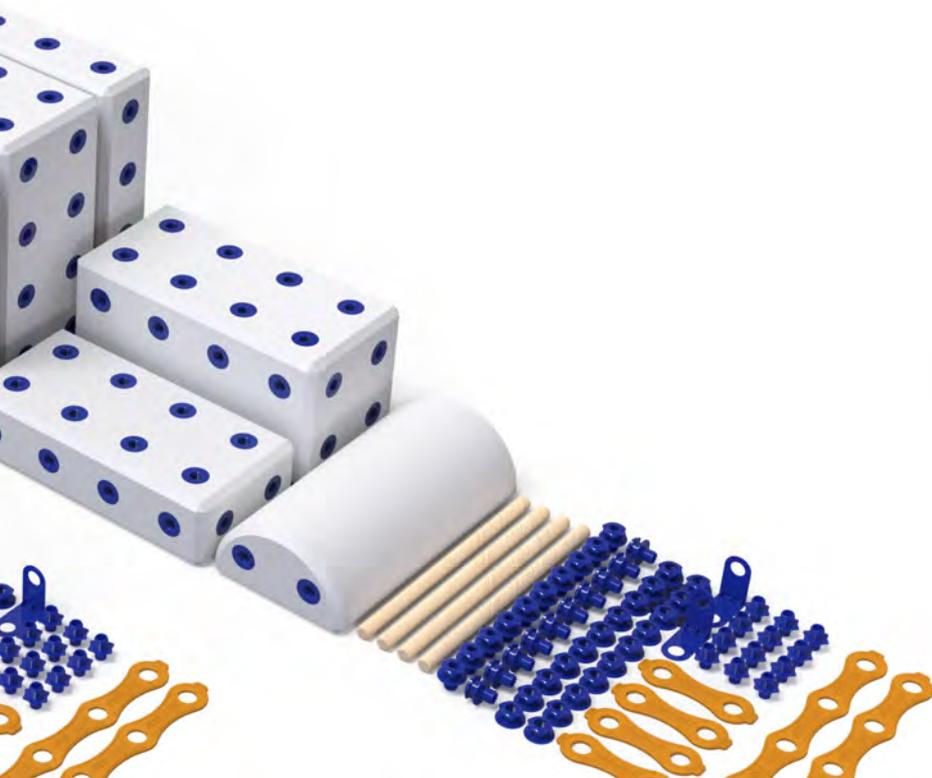


Image - (Ben Hermann, 2021)

Sustainability

The SōZō Play system has been designed around single part components for easy manufacturing, but the core use case also incorporates upcycled materials such as cardboard boxes, coffee cups and other common household items. This combined with a long product life cycle, all recyclable parts, and the ability for the product to be passed from one child to the next it has a high sustainability model.

The SōZō Play system is made from materials that are often found in children's toys. Ethylene-vinyl acetate (EVA Foam), Polypropylene (child-safe plastic), Silicone Rubber, and Solid Birch Wood are some of these materials. The packaging, which is also part of the product, is constructed of recycled paper and has a detachable printed slipcover.

The EVA block is the only portion that has mixed materials. Polypropylene screw inserts are cemented into place in these blocks. The inserts must be removed before the EVA and polypropylene may be recycled.

Should parts break individual parts can be purchased and replaced easily.



Image - (Ben Hermann, 2021)

Limitations

Whilst the product was tested on six children (under adult supervision) more in-depth user research is needed to refine the design. Due to the size on the block and the limited manufacturing/prototyping capabilities available to us, the entire system (including all components) could not be tested until much later in the development process. Whilst each individual part and components were tested early in the project, seeing how these components interacted together revealed design challenges that had not been previously observed.

Further Research

Because the SōZō Play system is designed to provide cooperative interactions between children and their parents/caregivers, the system has been designed with a level of complexity that makes using the system difficult for younger children. This was witnessed on several occasions where children became frustrating when parents weren't supervising a build. For this product to be successful parents need to remain actively involved in the build process. Further considerations need to be made to the design to see if these frustrating encounters can be avoided.

The benefits of ECD and play have been well documented and elements of problem-solving skills, trial and error, development, and object manipulation through guided interaction, encouraging guided interactions, make believe-play and pretend play to assist in developing creativity and abstract thinking have all been considered in this product. It is not known if this product provides and substantial ECD benefits to the children that use it. Further research in the how children use this product and the impacts that it has on their development is needed.

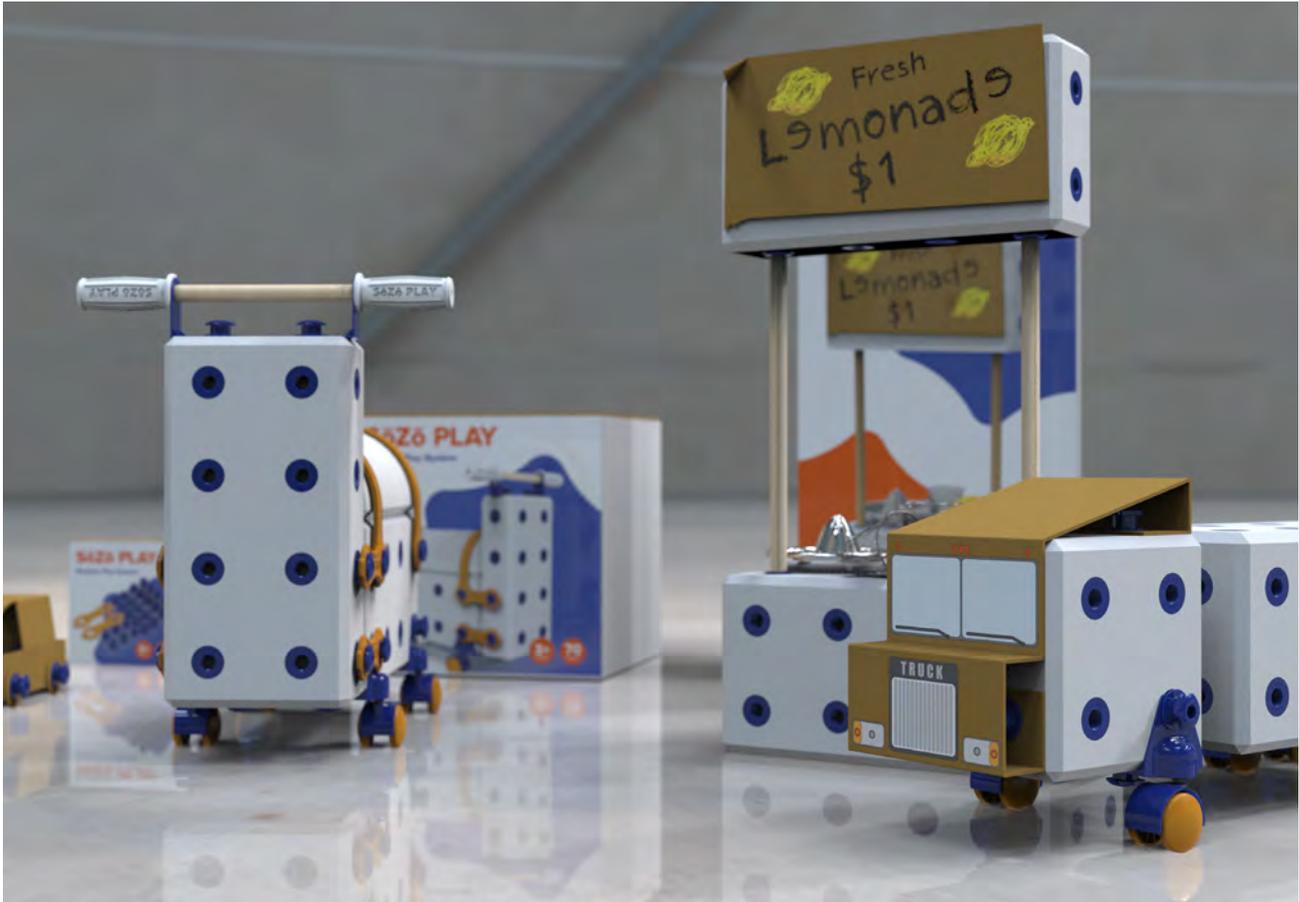


Image - (Ben Hermann, 2021)



Conclusion

The importance of early childhood development (ECD) is well documented and forms the basis for children achieving the best possible outcomes in life. Parents play a huge role in ECD and how they interact with their children can have a huge impact on them. Play is recognised as a key factor in how children learn and explore. It helps them understand the world around them and build important social and problem-solving skills. Providing children with quality learning opportunities can improve cognitive development, mental health, and social behaviour skills.

There are different types of play that help develop different aspects of a child's developmental needs. Practise play, constructive play, role play, pretend play, and fun play all work together to give children the best chance to succeed. Parents' commitment to their children is important, but there are several challenges that parents face. From busy lifestyles to external pressures and societal expectations. Researching ECD can be overwhelming as parents are faced with conflicting information. This makes it difficult to understand what their children need.

The toy industry is a profitable one, and there is a lot of research on the design of children's toys. Much of the literature focuses on marketing and not ECD, but it has been clearly recognised that design for children must meet children's needs to be successful. Designing children's toys with parents in mind can be beneficial as they are usually the ones making the purchasing decision, but overly complicated design or too much focus on educational elements can reduce the appeal to children. A product must clearly state what ECD benefits it provides for a child and where this information/research comes from so that parents can make an informed purchase decision.

Through research several opportunities have been identified that can be addressed through design. The aim is to improve interactions between children and their parents and caregivers through play. Focus on constructive play style, with a secondary focus on practice, role play, and pretend play. And by incorporation of problem solving, and cooperative play promotes child development and social skills. Play activities based on block/construction were the most popular activities among parents and children. The focus should be on these types of toys but may also include art, creative and role-play elements.

To improve parental involvement in play activities, the focus is on designing toys/activities with cooperative play and a shared interest between parents and children. The product/service should grow with the child to increase longevity and add value for the customer. A product that can be used both indoors and outdoors provides greater verticality for the user.

The designs proposed in Section 3 (Concepts and Ideas), aim to address the opportunities identified through the literature and primary data collection. Giving children the best opportunities to grow and develop should be the primary concern of every parent. And by supporting them in their learning and through meaningful interactions together, parents can give them the best possible start in life.

This product set out to answer the question "How can toys be designed in order to facilitate meaningful interactions between parents/caregivers and their children?"

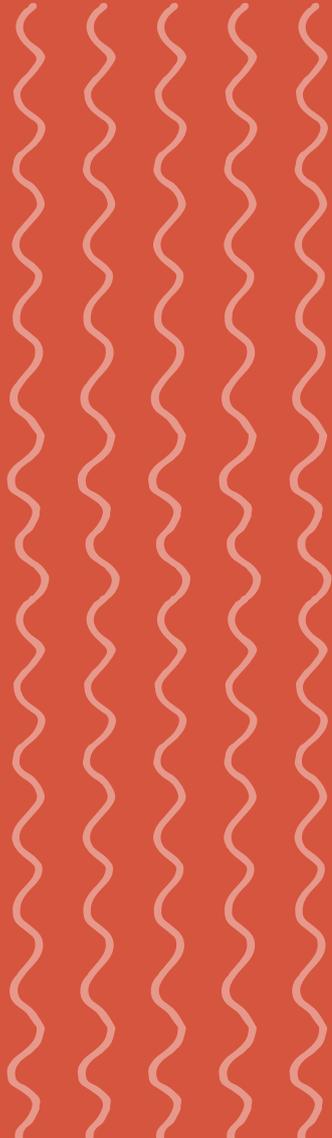
The SōZō Play system is a flexible modular system that allows for parents/caregivers to cooperate in building different play structures, modify them using everyday item from around the home and play with their creation either in their home or outside/doors.

The system is built at a degree of complexity that necessitates parental assistance during the build/construction phase but allows children to play with the object once it has been completed.

It incorporates many elements related to early childhood development including STEAM, problem-solving skills, trial and error, emotional development, object manipulation through guided interactions, role and make believe-play, and pretend play to aid in the development of creativity and abstract thinking.

It is made from materials that can be easily recycled and encourages children to upcycle items that would usually be thrown away. It is not limited by the components that are included with the product and the possibilities for customisation are unlimited.

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