

Adapting an Inclusive and Accessible Playground at Chaeli Cottage Preschool in Cape Town, South Africa



By:
Nick Battaglino
Amanda Borden
Kayla Condon
Henry Sniezek

Adapting an Inclusive and Accessible Playground at Chaeli Cottage in Cape Town, South
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By:

Nick Battaglino
Amanda Borden
Kayla Condon
Henry Sniezek

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Rosemary Luger,
The Chaeli Campaign

Professors Gbetonmasse Somasse and Thidinalei Tshiguvho
Worcester Polytechnic Institute

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Abstract

Children with disabilities in South Africa don't have access to quality education, including inclusive playgrounds. This project adapted a playground at Chaeli Cottage preschool to be more inclusive and accessible for students of all abilities. To create a beneficial product, our team conducted interviews with professionals and observed early childhood development centers to understand the needs of the users. We designed and built an inclusive playhouse, created a communication poster, and contributed to fundraising strategies at The Chaeli Campaign.

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Authorship

Table 1: Authorship

Section	Main contributor(s)	Editors
Abstract	Kayla	Henry, Amanda, Nick
Acknowledgments	Amanda	Henry, Kayla, Nick
Authorship	Amanda and Nick	Henry, Kayla
Table of Figures	Kayla	Henry, Amanda, Nick
Table of Tables	Kayla	Henry, Amanda, Nick
Executive Summary	Kayla	Henry, Amanda, Nick
Chapter 1: Introduction	Nick	Henry, Amanda, Kayla
Chapter 2: An Overview of Inclusivity and Playground Design	Amanda	Henry, Kayla, Nick
2.1 Current level of Inclusion of Disabled Students in South Africa	Amanda	Henry, Kayla, Nick
2.2 Partners and Stakeholders Promoting Inclusivity	Kayla	Henry, Amanda, Nick
2.3 The Importance of Universal Design in Playgrounds	Henry	Amanda, Kayla, Nick
2.4 Best Practices in Playground Materials and Layout Design	Nick	Henry, Amanda, Kayla
2.5 Summary	Kayla	Henry, Amanda, Nick
Chapter 3. Methodology	All	All
3.1 Identify the Needs of All the Users of the Playground	Nick	Henry, Amanda, Kayla
3.2 Expand The Chaeli Campaign's Fundraising Opportunities	Amanda	Henry, Kayla, Nick
3.3 Create and Test an Inclusive and Affordable Playground Design	Henry	Amanda, Kayla, Nick
Chapter 4: Findings	All	All

4.1 User Needs and Challenges of the Playground	Kayla	Henry, Amanda, Nick
4.2 Further opportunities for The Chaeli Campaign's Fundraising	Amanda	Henry, Kayla, Nick
4.3 Playhouse and communication Poster: An inclusive Playground Design	Henry	Amanda, Kayla, Nick
4.3.1 Playhouse Design	Kayla	Henry, Amanda, Nick
4.3.2 Building process of Playhouse	Nick	Henry, Amanda, Kayla
4.3.3 Communication Poster	Henry	Amanda, Kayla, Nick
Chapter 5: Conclusion	Amanda and Nick	Henry, Kayla
Recommendations	Kayla and Henry	Amanda, Nick
References	Amanda	Henry, Kayla, Nick
Appendix A: List of Interviewees	Kayla	Henry, Amanda, Nick
Appendix B: Interview Questions Set for Professional Staff at Chaeli Cottage	All	All
Appendix C: Interview Questions Set for Manager of Relations and Funds	All	All
Appendix D: Table of Responses	Kayla	Henry, Amanda, Nick
Appendix E: Registry Spreadsheet	Amanda	Henry, Kayla, Nick
Appendix F: Maintenance Guide	Amanda	Henry, Kayla, Nick
Communication Poster	Amanda and Kayla	Henry, Nick
Building the Playhouse	All	All

Table of Contents

<i>Abstract</i>	<i>iii</i>
<i>Acknowledgments</i>	<i>iv</i>
<i>Authorship</i>	<i>v</i>
<i>Table of Figures</i>	<i>ix</i>
<i>Table of Tables</i>	<i>x</i>
<i>Executive Summary</i>	<i>xi</i>
<i>Chapter 1: Introduction</i>	<i>1</i>
<i>Chapter 2: An Overview of Inclusivity and Playground Design</i>	<i>4</i>
2.1 Current Level of Inclusion of Disabled Students in South Africa.....	<i>4</i>
2.2 Partners and Stakeholders Promoting Inclusivity.....	<i>4</i>
2.3 The Importance of Universal Design in Playgrounds.....	<i>6</i>
2.4 Best Practices in Playground Materials and Layout Design.....	<i>7</i>
2.5 Summary.....	<i>8</i>
<i>Chapter 3. Methodology</i>	<i>9</i>
3.1 Identify the Needs of All Users of the Playground.....	<i>9</i>
3.2 Expand The Chaeli Campaign’s Fundraising Opportunities	<i>10</i>
3.3: Create and Test an Inclusive and Affordable Playground Design.....	<i>11</i>
<i>Chapter 4: Findings and Deliverables</i>	<i>13</i>
4.1 User Needs and Challenges of the Playground.....	<i>13</i>
4.2 Further Opportunities for The Chaeli Campaign’s Fundraising	<i>16</i>
4.3 Playhouse and Communication Poster: An Inclusive Playground Design	<i>19</i>
4.3.1 Playhouse Design	<i>19</i>
4.3.2 Building Process of Playhouse.....	<i>28</i>
4.3.3 Communication Poster.....	<i>30</i>
<i>Chapter 5: Conclusions and Recommendations</i>	<i>32</i>
Recommendations.....	<i>33</i>
<i>References</i>	<i>35</i>
<i>Appendices</i>	<i>38</i>
Appendix A List of Interviewees	<i>38</i>
Appendix B Interview Questions Set for Professional Staff at Chaeli Cottage.....	<i>38</i>

Appendix C Interview Questions Set for Manager of Relations and Funds	38
Appendix D Table of Responses from Interviews	39
Appendix E Registry Spreadsheet	40
Appendix F Maintenance Guide.....	41

Table of Figures

Figure 1: User Needs and Challenges on the Playground	xii
Figure 2: Communication Poster.....	xiii
Figure 3: CAD Rendering of Playhouse	xiii
<i>Figure 4: Picture of The Playhouse.....</i>	xiv
Figure 5: UN Sustainability Goals Relevant to the Project	2
Figure 6: Chaeli Cottage Playground.....	9
Figure 7: Disabilities Present at Chaeli Cottage, n=20	13
Figure 8: Playground Equipment that Promotes Growth	14
Figure 9 : Playground Equipment that is Exclusive, n=5.....	15
Figure 10: Safety Concerns, n=5.....	15
Figure 11: Specific Wants on a New Playground, n=5.....	19
Figure 12: Available Space for Playhouse	20
Figure 13: CAD Rendering of Playhouse.....	20
Figure 14: Drawing of Front Outside of Playhouse.....	21
Figure 15: Picture of Front Outside of Playhouse	22
Figure 16: Drawing of Right Outside of Playhouse	23
Figure 17: Picture of Right Outside of Playhouse.....	23
Figure 18: Drawing of Left Outside of Playhouse	24
Figure 19: Picture of Left Outside of Playhouse.....	24
Figure 20: Drawing of Front Inside of Playhouse	25
Figure 21: Picture of Right Side of Front Interior of Playhouse	25
Figure 22: Picture of Left Side of Front Interior of Playhouse	25
Figure 23: Drawing of Left Interior Side of Playhouse	26
Figure 24: Picture of Right Interior Wall of Playhouse	26
Figure 25: Drawing of Right Interior Side of Playhouse	27
Figure 26: Picture of Left Interior of Playhouse	27
Figure 27: Picture of Bamboo Siding	28
Figure 28: Communication Poster	31
Figure 29: Picture of the Playhouse.....	41
Figure 30: CAD Rendering of Playhouse.....	44
Figure 31: Drawing of Front Interior of Playhouse	45
Figure 32: Drawing of Front Outside of Playhouse.....	45
Figure 33: Drawing of Right Interior of Playhouse.....	45
Figure 34: Drawing of Right Outside of Playhouse	45
Figure 35: Drawing of Left Interior of Playhouse.....	46
Figure 36: Drawing of Left Outside of Playhouse	46

Table of Tables

Table 1: Authorship	v
Table 2: Grants Found From Grantmakers.io	18
Table 3: List of Materials	30
Table 4: List of Interviewees	38
Table 5: Table of Responses from Interviews	39
Table 6: Registry Spreadsheet	40
Table 7: List of Resources for The Playhouse	43

Executive Summary

Children with disabilities don't have adequate access to the quality education that their able-bodied peers receive, which makes it harder for them to follow the same path as their peers as they get older. In addition, children with disabilities are rarely given access to an inclusive and accessible playground. Playgrounds are important in the development of social, cognitive, and emotional growth and are therefore an essential part of a child's education.

The goal of this project was to adapt and create an inclusive and accessible playground for Chaeli Cottage, an inclusive early childhood development (ECD) center in Cape Town, South Africa. This ECD is run by The Chaeli Campaign, a nonprofit social justice organization with a mission to fight for disabled people's rights and provides resources to those in need.

To achieve the project goal, we:

- identified the needs of all users of the playground by conducting interviews with professional staff and observing students at ECD centers in Plumsted, Ocean View, and Masiphumelele.
- expanded The Chaeli Campaign's fundraising opportunities by interviewing the Manager of Relations and Funds to understand current fundraising strategies and participated in various fundraising events.
- created and tested an inclusive and accessible playground design by conducting interviews with staff at The Chaeli Campaign to acquire available resources and created a rendering of our design through Computer-Aided Design software.

Key User Needs and Desired Elements of the Playground Design

As seen in Figure 1, the majority of students at Chaeli Cottage have disabilities including Autism Spectrum Disorder (ASD), various syndromes, and using wheelchairs. Additionally, 50% of students have difficulty communicating verbally. Based on our observations at Chaeli Cottage, wheelchair users and students with visual impairments were most often left out of play during free time. Professional staff explained that sensory items are most beneficial to the growth and development of children, while a play kitchen, inclusive elements, and equipment that allows for eye-level interactions among peers are also important. Most people interviewed said that the playhouse was the most exclusive element

on the playground, followed by the sand pit and then the swing set. Finally, the professional staff explained that untreated wood equipment and sharp, loose objects were safety concerns that they had with playground equipment.

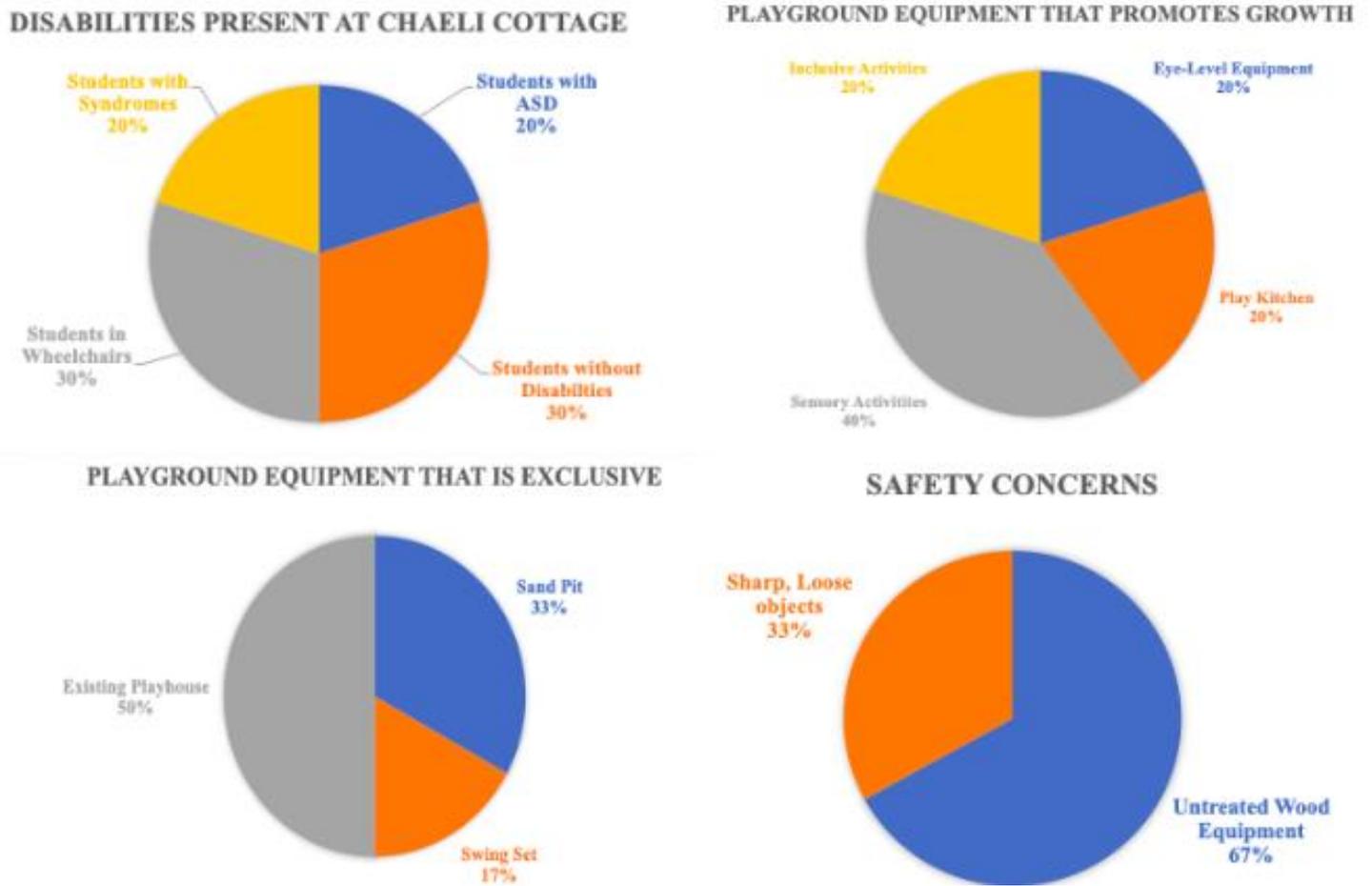


Figure 1: User Needs and Challenges on the Playground

An Inclusive Playground Design

To address the needs, challenges, and requirements of an inclusive playground, we created two key deliverables: a communication poster and an inclusive playhouse.

Communication Poster

With this information, we suggested and created a poster to support students with difficulties communicating. This poster includes labeled pictures of the equipment on the Chaeli Cottage playground to allow students to point and use their eyes to communicate their wants (Figure 2).



Figure 2: Communication Poster
Inclusive Playhouse

Our team designed and built an accessible and inclusive playhouse for students of all abilities (Figure 3). The key features of the playhouse were its size, sensory activities, and a sand table. The playhouse is large enough for wheelchair users to easily enter and move around inside. The sensory activities were chosen to be activities that all students could participate in, as well as allowing students to practice important skills like motor control and talking. A sand table was designed to sit inside and outside of the playhouse to allow as many children to play as possible. The height of the table was determined based on the average height of wheelchairs and standing frames as well as the heights of the children at Chaeli Cottage.

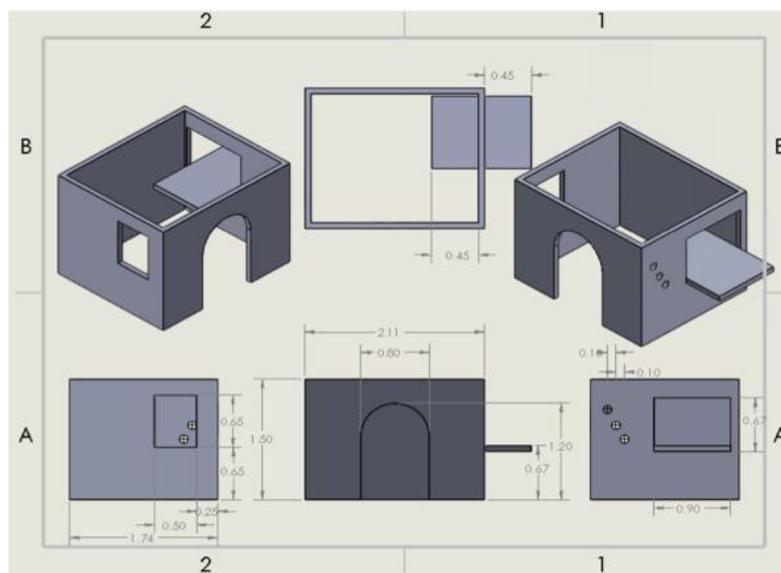


Figure 3: CAD Rendering of Playhouse

The materials chosen for the playhouse were based on natural elements and meant to mimic infrastructure in Cape Town (Figure 4). This includes a flat roof made from white DUROplastic to allow sunlight through. The walls of the playhouse were made from bamboo for two main reasons: the natural elements have been proven to have calming effects on children, and the natural gaps allow sunlight and visibility throughout the walls.

A maintenance guide was created in addition to the playhouse to provide The Chaeli Campaign with the necessary information (Appendix F). This included a CAD rendering of the playhouse to show accurate dimensions, a hand drawing of all walls of the playhouse to show inclusive elements and a list of materials used in the building process.



Figure 4: Picture of The Playhouse

A Registry for Consumable Products to Alleviate Financial Pressure

To expand The Chaeli Campaign's fundraising opportunities, our group first learned the current strategies that are being used. The Chaeli Campaign receives most of its funding from grants, including CSI funding and marketing budgets from large companies. To raise money for a specific need, such as a wheelchair for a child, fundraising events are utilized. To acquire funds for day-to-day operations, The Chaeli Campaign uses a donor subscription strategy.

To help alleviate financial pressure, our group created a registry using GoFundMe to collect money for the consumable products at both The Chaeli Campaign and Chaeli Cottage. Our goal was to raise enough money for two months' worth of supplies. As of December 16, 2022, we collected \$527 (R9,199.68). To help The Chaeli Campaign find grants, our team found two free grant databases to eliminate the need to pay for a database subscription. These websites are *Grantmakers.io* and *fundsforNGOs*, which provide information to find grants

that The Chaeli Campaign can apply as well as a newsletter that emails the information to organizations directly.

Limitations

The limitations of our project are as follows:

- This project was focused only on Chaeli Cottage and the disabilities of current students. Therefore, this sample of students is not representative of the whole disabled population and the final designs may not be inclusive of all disabilities.
- The final playhouse required a budget that was more expensive than anticipated.

Recommendations

Based on our findings, we recommend that **Chaeli Cottage** include the following in future additions to the playhouse:

- *Multiple heights to the sand table:* Therapists requested that there be multiple heights of the sand table to allow play for all students.
- *Additional sensory activities:* As the sample of students at Chaeli Cottage changes, it will be beneficial to the students to change the sensory activities to those that are tailored towards their wants and needs.

We recommend that the following methods are included in the **replication of the playhouse:**

- *Observing a larger sample size:* To make this design inclusive to a wider range of disabilities, the process for replicating the playhouse could be what we outlined throughout our report with a larger sample size.
- *Focus the design on the available sample of people:* If observing a larger sample size is not possible, it is important to focus the design on the specific needs of the users that the design is being made for.
- *Use donated and recycled materials:* Due to the budget for the final playhouse, we recommend using donated and recycled materials to replicate the playhouse for areas that don't have that money available.

We recommend that the following checks are completed periodically to ensure **safety in the playhouse:**

- *Sanding of the wood once a year:* This is to ensure there is no loose wood that can cause splinters or other injuries to students.
- *Security of activities once every three months:* This is to ensure that the sensory activities remain attached to the playhouse.
- *Clean the sand table once a year:* This is to ensure that the sand table retains its waterproofing quality and isn't deteriorating.
- *Checking the supports of the sand table once a year:* This is to ensure that the weight of the sand table is continuously supported over time.

- *Inspection for sharp objects twice a year:* This is to ensure that there are no sharp objects in the playhouse that can cause injuries to students.
- *Check for broken bamboo twice a year:* This is to ensure that the bamboo siding remains intact.
- *Clean the roof once every three months:* This is to ensure that there is no debris on the roof as the roof was not created to hold weight.

Chapter 1: Introduction

An inclusive education teaches all children that differently abled peers are equally capable and valuable. Students with disabilities face many barriers in accessing a proper education due to the lack of resources and support tailored to them. In South Africa, students who are differently abled lack many of the resources that are given to their able-bodied peers (Dalton, 2012). For example, students with Autism Spectrum Disorder are more likely to be excluded by the lack of accommodation and support in their school life (Martin-Denham, 2022). By not having the proper resources and accommodations, children with disabilities are excluded from critical interactions with their peers, such as during playtime on playgrounds. This exacerbates a divide in not only what these students can do, but also in how their fellow students and society view them.

All children, regardless of ability, use playgrounds to develop, grow, and become comfortable with peers. Play spaces enhance communication skills, problem solving abilities, and aptitude for cooperation and bonding with peers (Spencer, 2014). Furthermore, the different phases of growth require different levels of equipment and challenges in their playgrounds (Spencer, 2014). A case study in Sweden studied the behavior of children in multiple playground settings and they discovered that due to a lack of accessible playground components, differently abled children had far less opportunity to participate in social interactions (Prellwitz and Skar 2007). This greatly affects the children as it can hold back a child's mental development and may cause long term effects on how they socialize and communicate in the future.

Early childhood development centers in Cape Town, South Africa currently do not have the equipment to allow inclusive play for students of all abilities. Oftentimes, students with disabilities are left out at these schools because they are not inclusive (Stanton-Chapman, 2016; Stanton-Chapman, 2017). This makes organizations like The Chaeli Campaign essential because they are some of the only places where children with disabilities can receive a quality education. Chaeli Cottage preschool has the resources necessary to help these students learn and develop with their peers, however some of their playground equipment does not allow children of all abilities to participate. (The Chaeli Campaign, 2021; Zelda Mycroft, personal communication, September 8, 2022).

The Chaeli Campaign is a non-profit organization that was founded in 2004 by then-nine-year-old Chaeli Mycroft, her mother Zelda, sister Erin, and peers. They work together to

destigmatize differently abled people and to dispel the myth that they are less capable. Their efforts focus on schools and other organizations to create a more inclusive and accepting community of support. To promote its mission, the organization also advocates for the rights of children with disabilities. Chaeli and The Chaeli Campaign fight for the right to participate in the same opportunities for all people. Their persistence was demonstrated when Mycroft advocated for wheelchair users to be able to compete in the Comrades Marathon in 2016, making her one of the first wheelchair athletes to compete. In 2012, Mycroft was the first recipient of the medal of social activism awarded by the Nobel Peace Laureates and was selected as a Global Changemaker in 2018.

The goal of our project is to adapt a playground to be more inclusive to preschool children of all abilities at Chaeli Cottage to further the educational and outreach purposes of the school. Universal design is a topic we will be implementing in our project. It is the process of designing and building a structure or space that is available to all users. The design should provide the same means of play for all users and create equal opportunity in a way that doesn't draw attention to the fact that disabilities are provided for (National Disability Authority, 2020).

Our project falls within the scope of the United Nations Sustainable Development Goals. By providing an improvement in quality education and reducing inequalities within countries, this project is contributing to the UN's fourth and tenth goals of creating a safe place for all people by 2030 (Figure 5).



Figure 5: UN Sustainability Goals Relevant to the Project

Note. [photograph], by United Nations, 2022, United Nations (<https://sdgs.un.org/goals>).

To meet that goal, we have identified 3 objectives: 1) Identify the needs of all users of the playground; 2) Expand The Chaeli Campaign's fundraising opportunities; 3) Create and test an inclusive and affordable playground design. Focusing on these objectives will allow us

to contribute to the educational goals and outreach at Chaeli Cottage. The first objective is realizing the needs of the students at the school. This will allow us to build a playground that suits their needs. Without this, some children will be left out and unable to participate, which is exactly what is going on throughout the world. The second objective is to expand The Chaeli Campaign's fundraising opportunities by providing resources that help bring in more money. The Chaeli Campaign is a non-profit organization and does not have a reliable, steady means of acquiring money. With our efforts, we are hoping to create a more sustainable way for them to continuously bring in funds. This would take away the pressure and stress from relying on spontaneous large donations that create a lot of uncertainties and financial fluctuation. The third objective is to design a low-cost, easily replicable design. By keeping it low cost, potentially more schools can do the same thing and can provide similar opportunities for their students. If the goal of inclusion is achieved in the Chaeli Cottage model it could potentially serve as a baseline for mainstream schools in South Africa, thus impacting the way children with disabilities are treated in schools.

Chapter 2: An Overview of Inclusivity and Playground Design

In this chapter, we explore the issue of inclusivity of children living with disability in playgrounds in greater depth. We begin with an overview of perceptions of inclusion in South Africa and introduce the major stakeholders. Next, we discuss the importance of universal design in building inclusive play spaces. We summarize the current best practices in materials used and layout design. We highlight best practices for inclusive playground design and discuss five case studies that focus on the benefits of inclusive play and the specific designs of these playgrounds.

2.1 Current Level of Inclusion of Disabled Students in South Africa

Globally, 15% of people have some sort of disability that presents unique challenges in day-to-day activities (World Health Organization, 2022). In South Africa, 7.5% of the population experiences some type of biological or physical difference (Statistics South Africa, 2011). In response, there is a global effort to consider inclusion policies and to improve accessibility for disabled people. In the past twenty years, inclusive education in South Africa has gained attention. The development of the inclusive education system was first documented in the Constitution of the Republic of South Africa, Act No. 108 of 1996, which states that everyone has the right to basic education (Dalton, 2012). Children with disabilities have consequently received increased support as they transition into mainstream schools that provide them with quality education and accommodation for their needs (Dalton, 2012). However, in many cases, mainstream educators do not have access to the proper training or accommodations to support every student with disabilities. This lack of resources is directly affecting the cognitive thinking and social skills of disabled children because they are often left out of educational activities. As a result, organizations such as The Chaeli Campaign are important because they are a valuable support system for many children to get the aid they need.

2.2 Partners and Stakeholders Promoting Inclusivity

The Chaeli Campaign is one of the major stakeholders that will benefit from this project. Their efforts serve as an example for the community to promote the expansion and presence of inclusive playgrounds (The Chaeli Campaign, 2021). To understand the inspiration for this project, Chaeli Cottage is an inclusive preschool that is owned and run by

The Chaeli Campaign. This school strives to promote and provide mobility and educational needs for disabled children that are enrolled in the school and neighboring mainstream schools. Chaeli Cottage is a diverse school that currently has twelve students ages three to five years old. They represent a range of races, religions, and abilities. This school prides itself on creating a safe educational space for children whose disabilities have prevented them from attending a traditional preschool. Chaeli Cottage provides additional support to its students through weekly visits from occupational therapists, speech therapists, and physiotherapists who work with the students to develop physical, emotional, and verbal skills (Zelda Mycroft, personal communication, September 8, 2022).

The community surrounding Chaeli Cottage has much to gain from the universal adaptation initiative. An accessible space where all visitors feel they belong generates connections and reduces stigma (Middlemiss, 2021). The safety, socialization, and overall health of the community can be increased as they come together around a cause (Dalton, 2021; Middlemiss, 2021). Research has found that respect for each individual and the feeling of belonging throughout the whole community is elevated by inclusive educational systems (New Brunswick Association for Community Living, n.d.).

Studies have also shown that students are left out of play in many public spaces due to four main reasons: the equipment does not fit their needs, the facility is not safe for them, they have little interest in the equipment, and the equipment is not geared towards popular activities that the students like (Stanton-Chapman, 2016; Stanton-Chapman, 2017). By adapting playgrounds to fit these needs, students will spend time on the playground with their peers. Experiencing feelings of belonging can be a strong motivation towards participation in other educational settings, enabling all to develop their strengths to their best potential (New Brunswick Association for Community Living, n.d.).

Family members and staff at Chaeli Cottage are major stakeholders in our project. Teachers, physical therapists, occupational therapists, and speech therapists are some of the professions that are impacted by inclusive education in schools as they work directly with students on their individual challenges. These professionals and their families understand the barriers that students with disabilities face and therefore can advocate for them (Moore, 2015). All stakeholders have a lot to gain from this project as they are working directly with the children daily. By creating connections and open communication, playground guests will benefit, and the organization will be able to expand the mission of inclusive playgrounds. This process can be done using universal design protocols to allow disabled students to be supported without standing out.

2.3 The Importance of Universal Design in Playgrounds

Universal design in playgrounds is essential to creating a successful prototype that can be used in other play spaces (Burke, 2013). Universal design is the process of evaluating existing architectural designs and finding ways to provide the same means for all users (Scott, 2018a). These designs should be built with an identical design process whenever possible to make all components subtle so it does not stand out and segregate any users. According to Chaeli Mycroft, the best kind of accessible components are small, discrete things that do not automatically make people think it is for extra support. They are deliberately hidden to make the users feel like they are not standing out. According to the National Disability Authority, “By considering the diverse needs and abilities of all throughout the design process, universal design creates products, services, and environments that meet all people's needs.” (National Disability Authority, 2020) This states how universal design is not just a special requirement that will only benefit a small portion of its users, rather it is creating an inclusive design that is usable and convenient so everyone can benefit.

Universal design applies to education through universal design for learners. The universal design movement in the U.S. was created in response to the most recent Individuals with Disabilities Education Act of 2004 and the No Child Left Behind Act of 2001. This concept creates an accessible and barrier-free educational system for every student (Scott, 2018b). The goal of universal design for learners is that accessibility is initially provided in all spaces, and not a separate addition later. By focusing on inclusivity from the start, less attention is brought to the differences in individuals.

The three principles of universal design for learning are as follows: providing adequate representation, providing different levels of engagement, and providing different forms of activities for different levels of expression (Scott, 2018b). It is important to make these three principles a priority when designing our playground as it includes all users from the beginning.

Key ideas from a report by Burke titled, “Just for the fun of it: making playgrounds accessible to all children” are summarized below. Burke notes that the inclusion of children of all abilities in playgrounds creates a powerful shared cultural play that is passed along by children through generations. The involvement of children extends to all, both children with and without disabilities, and applies to those who are marginalized (Burke, 2013). For many children, playgrounds are one of their first few opportunities to interact with others and

develop their relationship skills. Differently abled children do not get to experience this due to differences in ability and development. All children deserve an equal chance to play, have fun, and act like kids; this does not mean that children with disabilities should be segregated into playgrounds designed just for them, and vice versa. Playgrounds can be universally designed to include all children, resulting in reducing ableism

A universal design approach to innovation is essential to meeting the demand for inclusive spaces. Thus, the design of playgrounds can consider differences as a characteristic of human diversity. Without segregating or stigmatizing anyone, universal design principles create a single product or environment.

This article demonstrates the importance of universal design to promote participation for all children, not singling out specific groups as that can further isolate children. As a stakeholder, the community is important in aiding the design process through interviews and suggestions as to what the needs are in the area. Universal design should be applied to the playgrounds to help facilitate healthy, fun, interactive, fair, vibrant, and inclusive play among children.

2.4 Best Practices in Playground Materials and Layout Design

From existing inclusive playgrounds, we can learn what has been successful, including specifications for surfaces, forms, and materials. The surface of playgrounds is often an overlooked aspect of what makes playgrounds accessible (Stanton-Chapman, 2019; Indiana Department of Natural Resources, n.d.). Wheelchair users often have difficulty moving around on surfaces such as wet grass and wood chips, so dry and smooth surfaces need to be used in playground areas to allow the greatest mobility for all users.

Similarly, pathway regulations are an easy way to give all users easy access to play equipment. Indiana Department of Natural Resources' standards is a minimum of 5 feet wide with no gaps over half of an inch. The surface must qualify as firm and stable, and the slopes of equipment cannot be more than 1:16.

Varying the layouts of play structures promotes different types of play. Open but small and designated areas were found to be the best space to promote social interactions among different individuals in small groups (Stanton-Chapman, 2016). Examples of these kinds of spaces include sandboxes and puzzles on walls. Similarly, themed zones can promote play for people of all abilities.

Activities that enhance the senses are beneficial to child development (Brown & Corry, 2011 as cited in Refshauge 2013). These sensory activities are also an inclusive space for all children to play together.

Equipment with vibration feedback is an easy way to include children who are hard of hearing and have visual impairments. Activities stemming from this kind of equipment allow all students to participate regardless of their differences based on the different senses that are not as active in playgrounds (Stanton-Chapman, 2017).

2.5 Summary

Current literature provides a wealth of resources and tools that can be implemented to make Chaeli Cottage a more inclusive playground. By studying inclusive playgrounds that have already been built and understanding the areas of success and failure, we have learned several key points that will inform our work moving forward. First, this can be done by developing strong relationships with key stakeholders to understand the need. Second, learning how to incorporate accessibility into universal design will allow us to make an easily replicated product. Third, incorporating physical infrastructure that has been successful in the past in our design.

Chapter 3. Methodology

The goal of our project is to design a playground at Chaeli Cottage to be more inclusive to preschool children of all abilities at Chaeli Cottage to further the education and outreach at the school. To meet that goal, we have identified 3 objectives:

- Identify the needs of all users of the playground
- Expand The Chaeli Campaign’s fundraising opportunities
- Create and test an inclusive and affordable playground design

This chapter describes the data collection strategy for each objective in greater detail and how it is analyzed. Achieving this goal will serve as a baseline for mainstream schools in South Africa, thus impacting the way children with disabilities are treated in schools.

3.1 Identify the Needs of All Users of the Playground

To identify the needs of all children at Chaeli Cottage, specifically those who are unable to participate in able-body activities, it is important to identify the students’ specific needs, requirements, and interests to create a beneficial product.



Figure 6: Chaeli Cottage Playground

Upon arrival at Chaeli Cottage, we began data collection through site observations during recess and interviews with the professional staff (Figure 6) (Berg, 2007). To obtain information from the staff at Chaeli Cottage, we performed informal interviews with professional staff, such as occupational therapists and teachers (Berg, 2007). The list of interviewees is in Appendix A. These conversations were focused on what the staff believes needs to change about the current playground based on what educational, social, and cognitive skills the students need more practice with and what their ideas are (see our Interview Guide in Appendix A). This method will be effective to get a clear idea of the staff's opinions to incorporate into the final design.

Similarly, our team observed five early childhood development (ECD) centers throughout the area to gather information about the educational system in mainstream schools. Our team attended ECDs in Ocean View and Masiphumelele to learn about promoting inclusion in mainstream schools and to observe students with different behavior and intellectual needs that were unable to get the support they needed due to untrained staff and low budgets. We observed Chaeli Cottage's therapist Luger in a teacher workshop in Ocean View to learn about incorporating therapies into the educational system. We also observed Luger in a parent-teacher conference in Masiphumelele for a Grade R (kindergarten) student in a mainstream school who is being forced to move to a special needs school in a different community. This gave us a better understanding of the lack of inclusivity in mainstream schools.

Our team also spent time in the classroom at Chaeli Cottage and observed the day-to-day activities and learning that go on in the classroom and on the playground. The goal of this observation was to get more familiar with the needs and wishes of the students and staff at the school and observe how they accommodate the students thus far.

We interviewed professional staff to learn about their concerns and wants to design the most beneficial equipment. In the interviews, we also collected data on the kinds of additional support needed and any safety concerns with the existing equipment.

3.2 Expand The Chaeli Campaign's Fundraising Opportunities

Expanding The Chaeli Campaign's current fundraising strategies is an essential component to the future expansion of inclusive play spaces at Chaeli Cottage and other early

childhood development centers in the area. Our fundraising efforts will be directed toward improving and contributing to the current fundraising strategy sustainably.

To understand the current fundraising strategies, our team interviewed Chaeli Mycroft, the Manager of Relationships and Funding, to understand the current fundraising strategies (Appendix C). The questions were asked to gain a deeper understanding of how The Chaeli Campaign receives its funding as well as what strategies have been successful and unsuccessful in the past. This interview also served to clarify our fundraising objectives related to our project and the organization.

To promote fundraising for this specific project, our team attended The Chaeli Campaign fundraising events during our time in South Africa. Specifically, we attended The Chaeli Campaign Classic Golf Day on November 10, 2022. We promoted this event to our peers to bring in more funds for The Chaeli Campaign. At this event, we talked to community members to gain support for our project.

We promoted The Chaeli Foundation's Giving Tuesday on November 29, 2022, on our team's social media accounts to expand the awareness of the organization within our network. The Chaeli Foundation is The Chaeli Campaign's partner in the United States. The Chaeli Foundation works closely with The Chaeli Campaign, as well as sharing funds.

To assist The Chaeli Campaign in expanding its funds, we researched grants and funding opportunities to provide the organization with the resources to apply. We investigated organizations like Changing the Present and the Christopher and Diana Reeves Foundations which are large groups that fund nonprofits that focus on inclusion and disability advocacy. Our goal was to find the resources that are necessary to apply for grants of this type in the United States so that it will be an easy application process for The Chaeli Campaign in the immediate future.

Similarly, our team researched the fundraising strategies of organizations like The Chaeli Campaign. The goal of this approach was to find grants and donors that were interested in funding missions like The Chaeli Campaign. Some of these grants and organizations are as follows: Changing the Present, Christopher and Dana Reeve Foundation, and Disability Funders Network.

3.3: Create and Test an Inclusive and Affordable Playground Design

Due to limited resources, finding simple and affordable materials is a key objective to meet the goal of our project. To do this, we used recycled, donated, and affordable materials

to build and adapt equipment. Our first step was to assess what equipment was readily available for our use.

Rosemary Luger (the Occupational Therapist, and the Director of Therapies at The Chaeli Campaign) gave our team a tour of the property and showed us all the available equipment. We conducted an interview with Luger to learn more about the materials they have and what is important to be included in our design. We learned that sensory items, textures, colors, and moveable objects are all important to use in our design. Chaeli Cottage has an abundance of useful items such as tires. They also have some wheelchairs, chalkboards, blocks, AstroTurf, rope, stairs, and benches that we can use to aid in our project.

We conducted informal interviews with the staff at Chaeli Cottage to learn more about the resources the school can acquire. The interview questions for these conversations can be found in Appendix B. This is important as we adapted our efforts based on the therapists' feedback as to what worked and what didn't. We began the design process by visiting Builders Warehouse to obtain information on materials that were durable and sustainable. From there, we brainstormed the specific structure of the design based on the needs of the children at Chaeli Cottage. Based on this design, we drew the playhouse through Solidworks to have a working computer drawing with accurate dimensions.

Once our team completed our Computer-Aided Design drawing, through Solidworks software, we connected with members of the community to obtain specific resources and time donations. This was done by sending a WhatsApp message to the parents and staff at Chaeli Cottage. We also asked other WPI students in Cape Town to share our WhatsApp message with their communities as well so that our connections were deeper.

To construct our design, we utilized the resources at The Chaeli Campaign, such as the handyman and donated materials and tools, to achieve our goal of building a completed product for Chaeli Cottage.

Chapter 4: Findings and Deliverables

This chapter focuses on the findings that went into creating our design, the playground design, and the building process including where and how we get materials. It also goes into detail about our other two deliverables, namely, a poster of the play equipment at Chaeli Cottage and a document advising fundraising strategies and connections for the Chaeli Campaign.

4.1 User Needs and Challenges of the Playground

To achieve our goal of creating inclusive and accessible playground equipment, we needed to identify the disabilities and differences present at Chaeli Cottage. The following graph shows how many students have each type of disability (Figure 7).

DISABILITIES PRESENT AT CHAELI COTTAGE

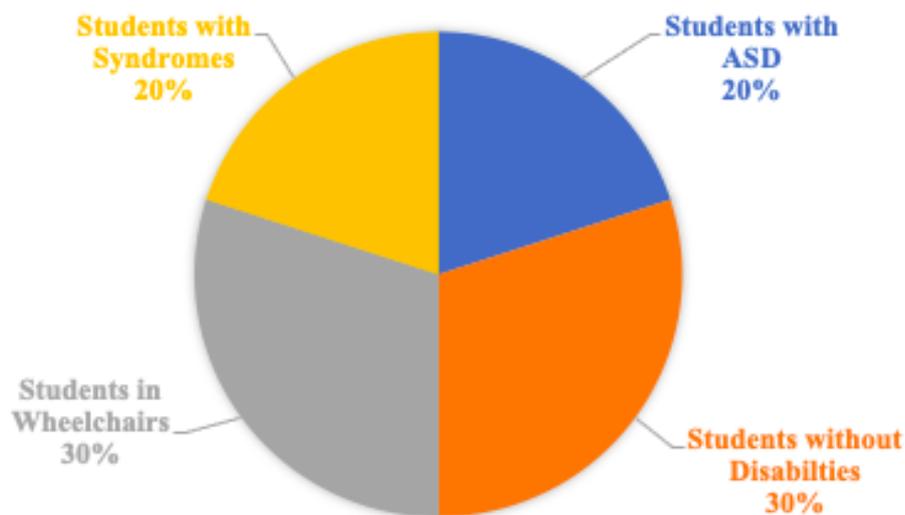


Figure 7: Disabilities Present at Chaeli Cottage, n=20

While the Chaeli Cottage playground had a few accessible and inclusive elements, we determined that the existing equipment was mainly excluding students in wheelchairs. This was determined through observations where our group noticed the students in wheelchairs being left out of play. We also noticed that equipment, such as the existing playhouse, the sand pit, and the jungle gym were not accessible to students in wheelchairs. A summary of the concerns and successes of the current playground expressed by professional staff at

Chaeli Cottage is displayed in Appendix D. Our team interviewed all professionals that work for Chaeli Cottage. It is important to note that while this number is small, all professionals at the preschool were included in the research. The frequency of each response when asked the following questions are shown in the graphs below. Figure 8 shows that 40% of interviewees explained that sensory activities promote the growth and development of students while 20% said that inclusive activities, the play kitchen, and equipment that allows for eye-level interaction among peers, respectively, accomplished this. Figure 19 shows that 50% of interviewees expressed concern with the size and exclusivity of the existing playhouse structure and 33% expressed concern with the exclusivity of the sand pit structure. The main safety concern presented was the equipment made of untreated wood with a 67% response rate, as shown in Figure 10.

PLAYGROUND EQUIPMENT THAT PROMOTES GROWTH

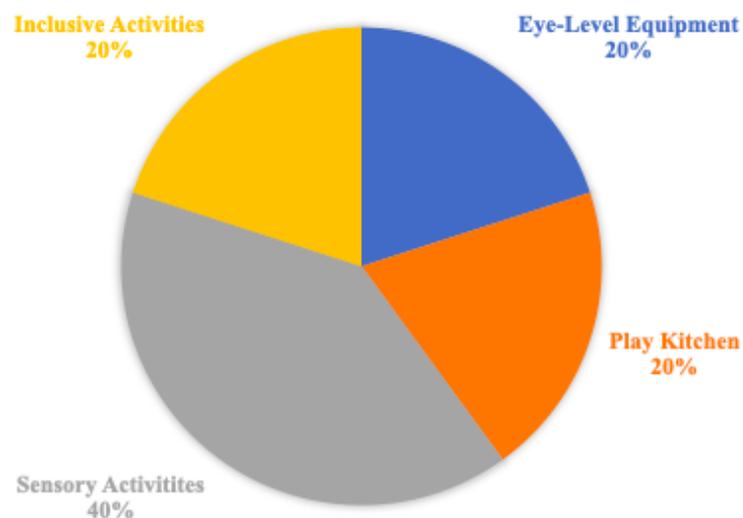


Figure 8: Playground Equipment that Promotes Growth

PLAYGROUND EQUIPMENT THAT IS EXCLUSIVE

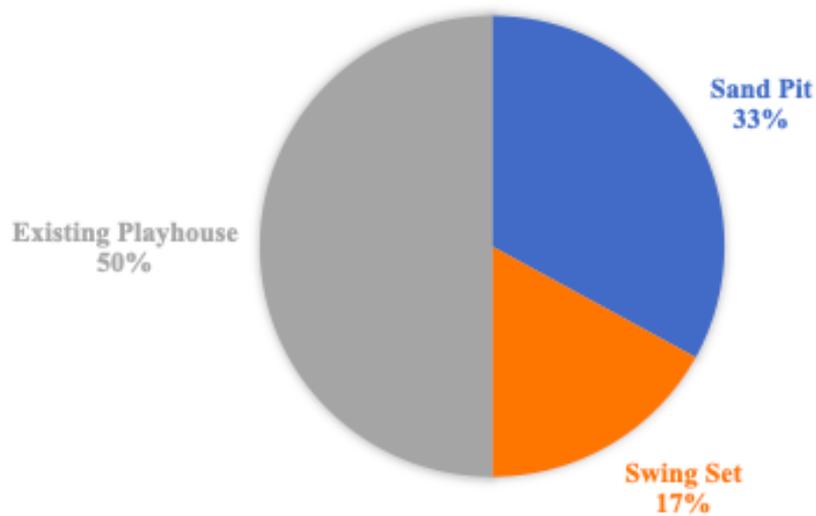


Figure 9 : Playground Equipment that is Exclusive, n=5

SAFETY CONCERNS

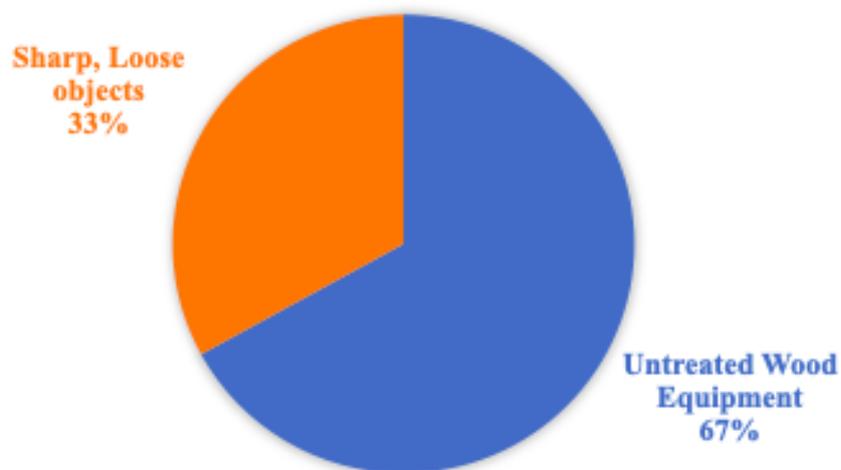


Figure 10: Safety Concerns, n=5

Observations of students during playtime also showed that they found interest in the sandpit and the imaginative play equipment, such as the play kitchen. Oftentimes, many students were found inside or near the playhouse. The students in wheelchairs were most often left to play alone as they were not able to play with the existing pieces of equipment.

Specifically, one student in a wheelchair spent a lot of time playing with the play kitchen but had difficulty reaching all its components due to no room for her wheelchair to fit underneath the equipment.

Another major challenge on the playground was the lack of communication tools for students who have difficulties communicating verbally. Interviews demonstrated the need for additional communication support due to the large proportion of students at Chaeli Cottage who have difficulties communicating verbally. Ten of the nineteen students at Chaeli Cottage either cannot speak or do not feel comfortable talking. These students communicate in different ways, such as with their eyes, pointing, using body movements, and different tones of verbal noises. The playground currently does not have any tools in place to aid these students in their communication, making it difficult for these students to communicate and interact with their peers. Play spaces need to be welcoming and inviting so that the children feel included in the area. If a student cannot communicate what they want to do or don't know how to say what they want to do, then they might feel upset and distant from everyone else. The playground should be treated as an extension of the classroom, meaning that it is supposed to be used by all children equally. To address this issue, we created a communication poster (see Section 4.3.3).

4.2 Further Opportunities for The Chaeli Campaign's Fundraising

Currently, The Chaeli Campaign has three funding streams, which are through grants, fundraising events, and sustainability strategies.

Grants include CSI funding grants (corporate social responsibility), sponsorships from large companies, and government funding. The Chaeli Campaign receives most of its money through these grants and fund programs like their cause. Private grants are found through online grant databases that require a subscription. Recently, The Chaeli Campaign has not been able to pay the subscription and therefore has had a hard time finding private grants they are eligible for. These subscriptions are expensive, as they cost a minimum of \$150 a month. These grants are often awarded to organizations with large amounts of money for a certain amount of time. After this set amount of time, organizations like The Chaeli Campaign often experience major financial difficulties as it is a long and difficult process to acquire new grants. Even if the organization is continuously applying for grants, these periods of little funding still occur. For this reason, The Chaeli Campaign is currently experiencing major financial difficulties that affect the daily operation of the organization.

Goal-oriented fundraising events are the main method of acquiring money for a specific outcome. Examples of these events are the Golf Classic and road races that are targeted toward getting funding for a motorized wheelchair. This method has proven successful to reach its goals and bring awareness to The Chaeli Campaign, but it does not provide continuous funds to keep the organization running.

The last way The Chaeli Campaign gets its funding is through long-term strategies, such as a donation subscription. With a donation subscription, a donor gives money to the organization monthly. This allows for a continuous supply of money. This method is still being developed and is what is used to pay for necessities and the day-to-day operations of the organization. There are currently 15 pledge partners and are looking to drastically increase that number. Pledge partners decide how much money they donate and how long their subscription lasts. This method has proven successful, but it is not developed to its full potential. Pledge partners sign up through an online form on The Chaeli Campaign's website or flyers at fundraising events. Although a donation subscription is a viable option, it has not gained enough traction to make a difference because of the difficulty of finding new donors. The current pledge partners do not donate enough money for this funding strategy to make the difference that is needed,

Due to the need to increase funds for the day-to-day operations at The Chaeli Campaign, our team created and advertised a registry for these materials. The registry included consumable products both The Chaeli Campaign and Chaeli Cottage use. This registry was created through the GoFundMe platform. Attached to the page was a link to a spreadsheet that displayed the items needed and their prices (Appendix E). This registry was advertised mainly through our team's network in the United States, specifically friends and family. We posted the registry on WPI's Global Instagram page as well. As of December 16, 2022, we collected \$527 (R9,199.68). This registry was a short-term solution to the financial difficulties The Chaeli Campaign is currently experiencing. The goal of this registry was to alleviate some of the day-to-day financial pressure the organization is currently under to allow them to strategize and secure longer-term funding to support its mission.

To contribute to The Chaeli Campaign's process of finding grants, our team researched free online grant databases to help The Chaeli Foundations identify grants in the United States. These resources were presented to the Manager of Relations and Funds at The Chaeli Campaign. The first database found was Grantmakers.io, <https://www.grantmakers.io>. This is a free service made for small nonprofit organizations that has a database of information on grants to apply for. Because this database is free, it does not provide all the

services needed to apply for grants. However, this resource does provide a history of grants and their recipients offering The Chaeli Campaign the information they need to seek new donors and networking opportunities. Specific donors or keywords can be used to search for grants that match The Chaeli Campaign’s mission. Using the information from Grantmakers.io, The Chaeli Campaign can focus its efforts on applying for these grants directly. Table 2 shows examples of grants and donors found when specific keywords were searched.

Table 2: Grants Found From Grantmakers.io

Keyword searched (if found on Grantmaker.io)	Donor name	Organizations that donated	Amount donated
Inclusion; child; Playground	Dennis and Phyllis Washington Foundation	Rose Park Elementary PTA	\$20,000
Disability; Child	Steve Mihaylo and Lois Mihaylo Foundation	Support for Families of Children with Disabilities	\$3,500
Disability; Child	Bridgewater Fund	Community Haven for Adults and Children with Disability INC	\$2,500
Disability; Child	Vista Hermosa	Kupenda for the Children	\$80,000
Disability; Child	Pat and Mark Warren Family Foundation	Ability First	\$150

FundsforNGOs, <https://www.fundsforngos.org>, is another database that can help find grants in the U.S. While the free version of this database is not as extensive as Grantmakers.io, this platform provides free newsletters that send information directly to the organization to eliminate the need for them to do research. Signing up for these newsletters is made very simple by the button “Subscribe for Free” located at the top of the website’s homepage. All that is required to sign up is the user’s name, email address, and country. While we were not able to sign The Chaeli Campaign or The Chaeli Foundation up for this service, this process is something that both their foundations can easily do. The goal of these resources was to help The Chaeli Foundation’s grant funding process while they were not able to pay for a database subscription.

4.3 Playhouse and Communication Poster: An Inclusive Playground Design

This section explains the two deliverables that were added to the Chaeli Cottage playground to increase its accessibility and inclusivity. The first deliverable is a playhouse that is inclusive to users of all abilities. The second deliverable described is a poster meant to help students communicate with their peers on the playground.

4.3.1 Playhouse Design

Through interviews with the professional staff at Chaeli Cottage, we determined the needs and wants of the professional staff based on their experience with the students. The question was open-ended and phrased the following way: “Do you have any ideas or specific wants in new playground equipment, specifically tailored to children that are typically excluded?” (Figure 11). This data suggested that a playhouse that is wheelchair accessible is the most wanted piece of equipment on the playground at Chaeli Cottage.

Specific Wants on a New Playground

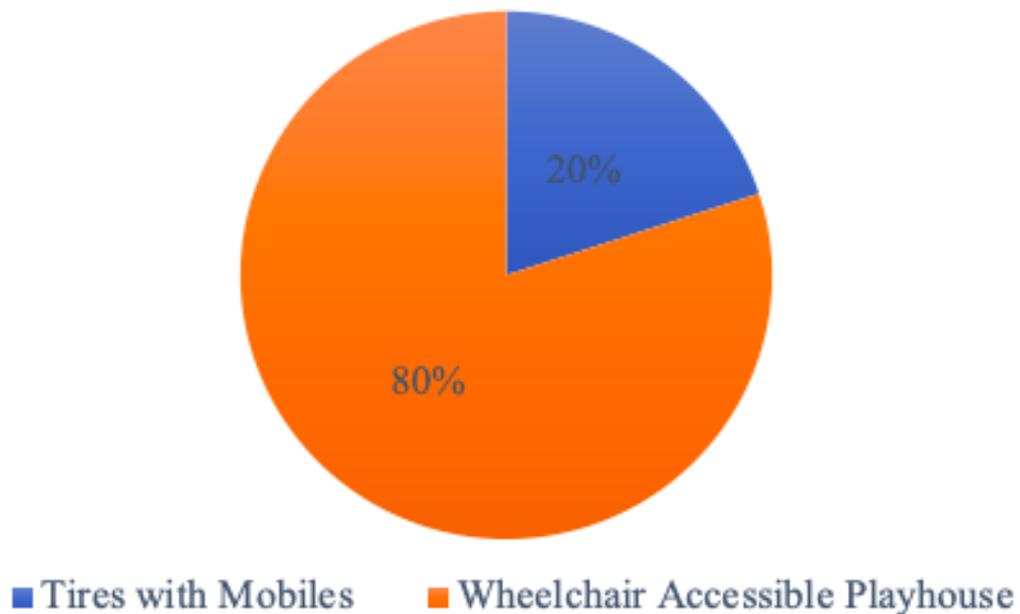


Figure 11: Specific Wants on a New Playground, n=5

We also based the design of the equipment on the student’s abilities and interests (Woolley and Lowe, 2012). Based on feedback from the professional staff at Chaeli Cottage as described in Section 4.3, we determined that an inclusive and accessible playhouse structure that featured an inclusive sandpit was the most important piece of equipment to be added to the Chaeli Cottage playground. This structure specifically needed to be large enough that wheelchairs could fit inside and move around. Similarly, this playhouse needed to

include a sand table that was tall enough to allow wheelchairs to fit underneath to allow students in wheelchairs to be able to play with the sand with their peers.

The creation of a playhouse that is accessible and inclusive to promote interaction and development is consistent with findings in the literature. Playhouses allow for the development of socialization, communication skills, fine and gross motor skills, and the use of one's imagination (Spencer, 2014). In a case study by Maria Prellwitz, it was noted that the children found playgrounds, especially when no adults were present, as a place of sanctuary for private conversations and interactions (Prellwitz, 2007).

Based on the emphasis on sensory items, we decided that it would be beneficial to include activities on the walls of the playhouse to promote students to play with these items and interact with their peers.

The playhouse was designed to be put in the space shown in Figure 12. This location was chosen due to the wall of the school building and other existing structures that could be used for support. This location also allowed for the sand table to be next to the existing sandpits to allow for all the sand play to be contained in one area. Additionally, this space is already covered by a roof allowing for more creative options to be used as a roofing material.

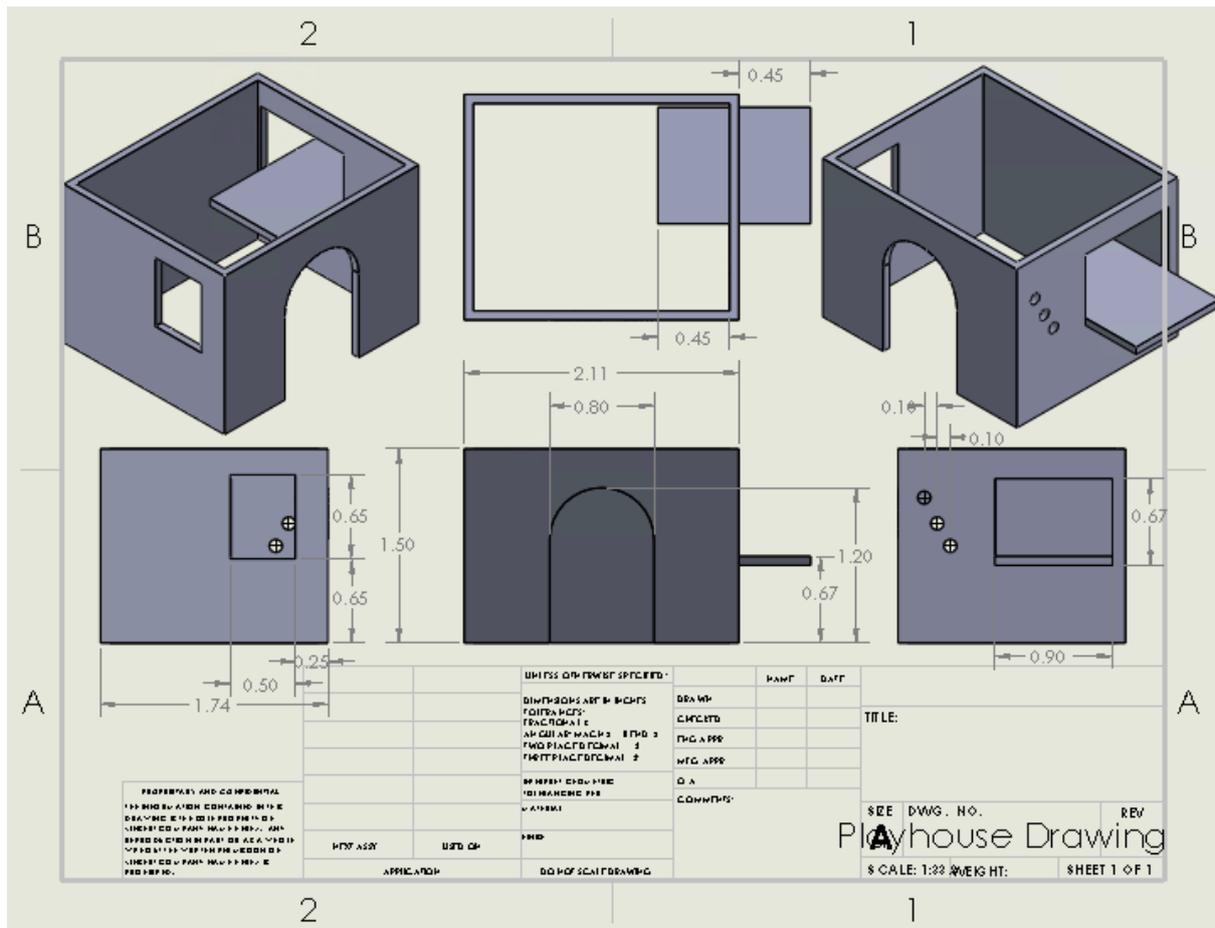


Figure 12: Available Space for Playhouse



The playhouse that was designed to fit all the needs is shown below in Figure 13.

Figure 13: CAD Rendering of Playhouse



The front of the playhouse is designed with a doorway large enough to fit preschool children of different heights as well as wide enough to easily fit the different wheelchairs used by students at Chaeli Cottage. These measurements were determined by measuring the heights of students and the dimensions of the different wheelchairs. The school's physio expressed the need for arches in doorways to prevent feelings of claustrophobia in students in wheelchairs (Ann Bullen, personal communication, November 1, 2022). To the left of the doorway is a chalkboard and shelf to hold chalk and erasers. The chalkboard is designed to sit in between two open spaces to allow students in wheelchairs to be able to reach it. The area left of the doorway includes an abacus low to the ground and an assortment of buttons. The abacus consists of beads on strings that act as a sensory item that students can play with. The buttons are an additional sensory item placed next to the doorway to mimic a doorbell and promote imaginative play among the students. These specific elements can be seen in Figures 14 and 15.

Figure 14: Drawing of Front Outside of Playhouse

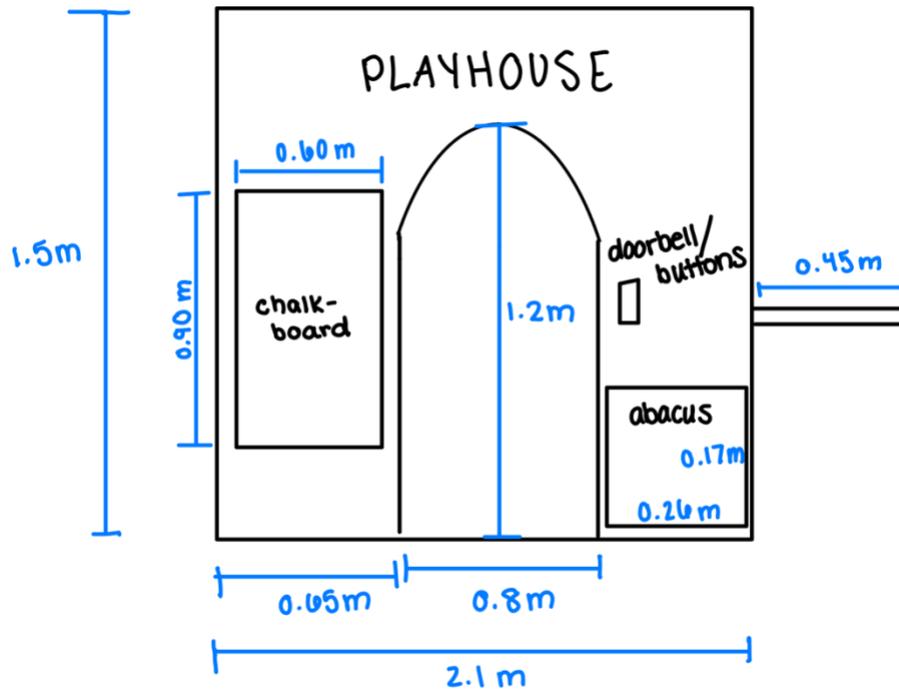


Figure 15: Picture of Front Outside of Playhouse

The right wall of the playhouse (Figures 16 and 17) contains the sand table as well as PVC piping talking tubes. Its height was determined based on the standard wheelchair heights at Chaeli Cottage. This allowed students to play with the sand table on both the interior and

exterior of the playhouse, as well as allowing students in wheelchairs to fit underneath the table and have a full range of motion of their arms.

To the left of the sand table is a set of three talking tubes that allow students to communicate back and forth with their peers. These are designed to be at different distances from the ground to allow students of all heights to be able to play.

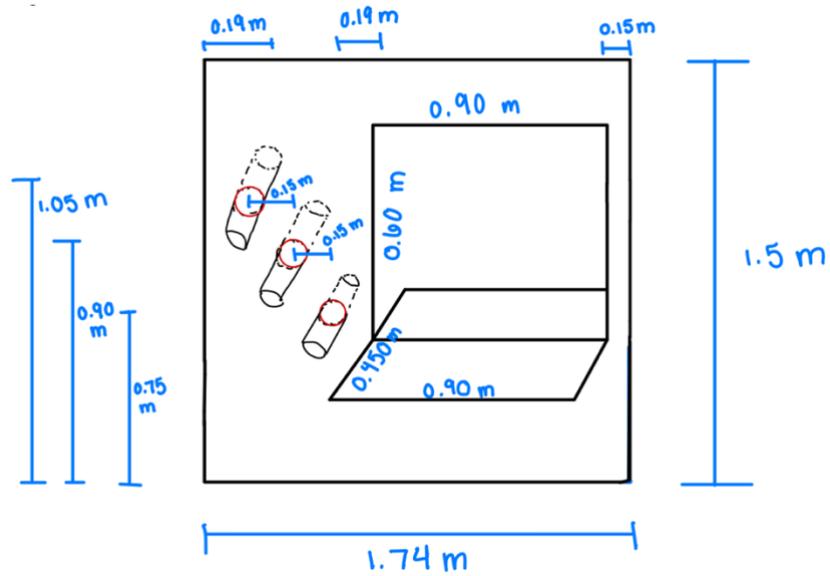


Figure 16: Drawing of Right Outside of Playhouse



Figure 17: Picture of Right Outside of Playhouse

The left wall of the playhouse contains a window and a funnel ball game on the exterior of the playhouse (Figures 18 and 19). This window allows light and visibility into the playhouse, specifically for teachers to monitor the students' play. The funnel ball game consists of PVC piping. This activity was designed based on the motor skills it provides students, as explained by Luger.

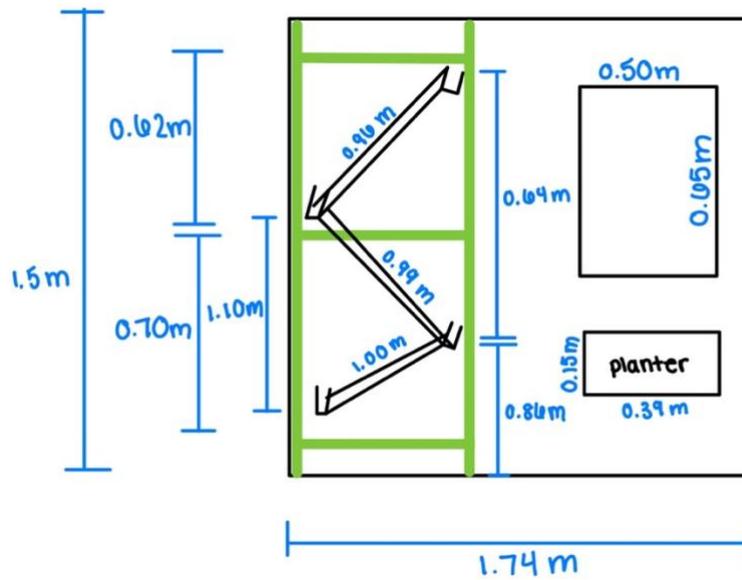


Figure 18: Drawing of Left Outside of Playhouse



Figure 19: Picture of Left Outside of Playhouse

The interior walls of the playhouse (Figure 20-26) were left empty except for one abacus feature on the front wall. The height of the abacus was designed to fit the older and taller students at Chaeli Cottage. The open space inside the playhouse was designed to allow students to bring toys inside, such as a play kitchen Chaeli Cottage currently has. This open space allows and encourages more imaginative play and interaction among students.

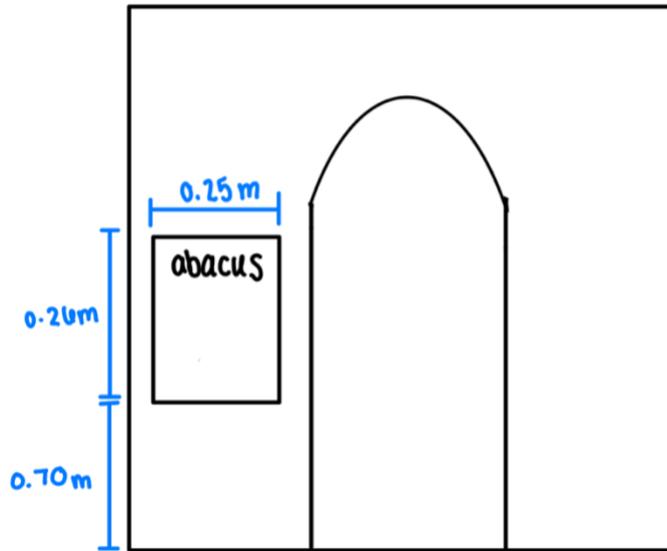


Figure 20: Drawing of Front Inside of Playhouse



Figure 22: Picture of Left Side of Front Interior of Playhouse



Figure 21: Picture of Right Side of Front Interior of Playhouse

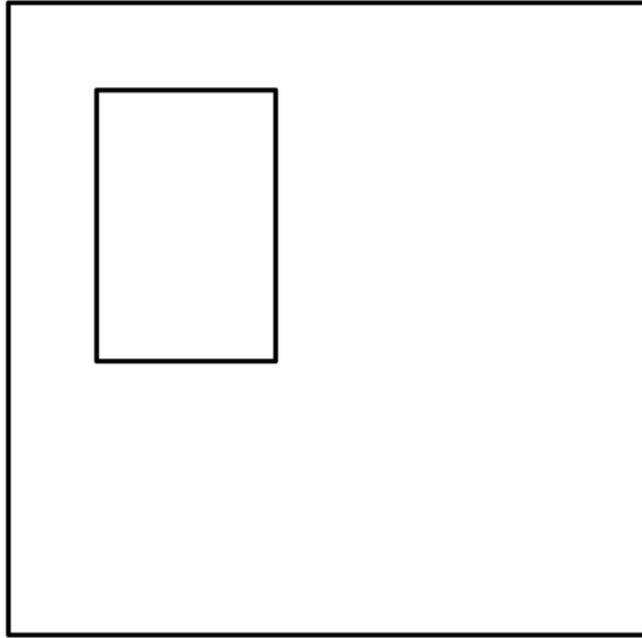


Figure 23: Drawing of Left Interior Side of Playhouse



Figure 24: Picture of Right Interior Wall of Playhouse

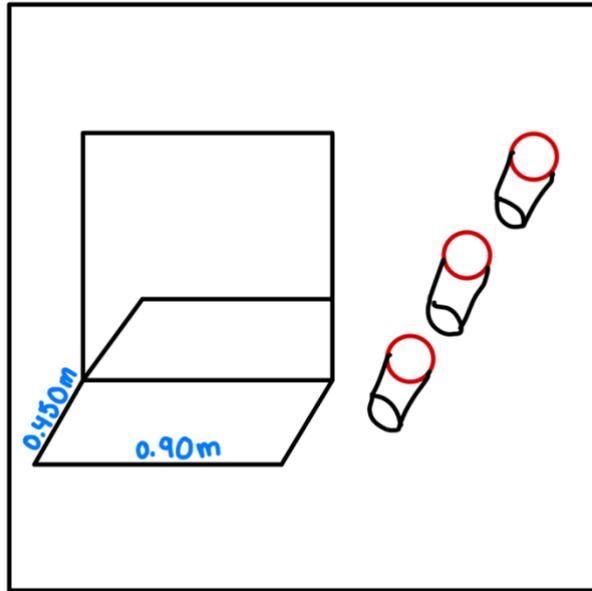


Figure 25: Drawing of Right Interior Side of Playhouse



Figure 26: Picture of Left Interior of Playhouse

4.3.2 Building Process of Playhouse

This project was supported through an endowment fund received by WPI in 2008 from General Electric. The 2008 General Electric Foundation Fund aims to help international educational organizations.

The wood supplies for our project all came from Somerset Timbers, and all the various non-wood items we used are from Builders Warehouse. We purchased South African Laminated Pine Beams. These were chosen for the framing of the playhouse due to their strength and durability. They were essential in building the vertical structure. We used pressure-treated Exterior Pine Plywood was used for the sand table. We sanded down the plywood on the edges to avoid any chance of splinters and provided a protective coat of waterproofing. This wood was chosen to be used because it was the best option available due to its strength and weatherproof qualities. While treated wood can be toxic, our structure will be covered with a protective coat of Exterior Wood Care Preservative by Plascon. This is to prevent the toxins from escaping as well as making the wood waterproof.

We used bamboo as a siding for the playhouse (Figure 27). This was a donation from Happinest; if this product needs to be purchased in the future it is available at Builders



Figure 27: Picture of Bamboo Siding

Warehouse. Bamboo is beneficial because the adults can see through it, but the children feel enclosed for privacy. This is a benefit to the development of the students as bamboo is a

natural element that can stimulate a child's perceived risk and adventure while also showing beauty and having a calming and peaceful effect on the children (Spencer, 2014).

Our other means of acquiring materials were through Builders Warehouse. We used timberlok screws to connect all the wood pieces and Exterior Wood Care Preservative to waterproof the sand table. We also bought wood glue to fill in the gaps left by some of the screws and long screws to fasten the bamboo facade onto the framing.

Happinest greatly supports The Chaeli Campaign; Happinest along with the technical support staff member at The Chaeli Campaign loaned our team tools that were used to build the playhouse. We mainly used a screw gun for the screws, a paintbrush to apply the waterproofing, and a jigsaw/circular saw to cut the wood.

The construction process started by measuring out the posts and cutting them down based on what is needed with a circular saw at Happinest. We then constructed the framing for each wall and window on the ground and used the timberlok screws to join the pieces. Once the framing for each wall was done, we set them in place and fastened them together with more timberlok screws. Next, we cut the bamboo facade with a jigsaw to fit the walls and windows and screwed them into the frame joists with 45mm screws. From there we focused on building the sand table out of the exterior pine plywood; once completed we sanded the edges and coated it in waterproofing. The next step was screwing in the polycarbonate sheeting for the roof and adding interior and exterior sensory items such as the ball game, chalkboard, and abacus for inclusive play.

A completed list of materials and a budget for the playhouse is shown below in Table 3. This will aid Chaeli Cottage in repairing or replacing any equipment associated with the playhouse. A maintenance guide was presented to The Chaeli Campaign (Appendix F).

Table 3: List of Materials

Item	Purpose	Amount	Cost (ZAR) as of 12/7/2022	Provider
Laminated Pine Posts 70mmx70mm, 2.4m long	Corner Posts and Framing	16	3120	Somerset Timbers
Water Resistant Particle Board	Sand Table	1	760	Somerset Timbers
Bamboo	Siding	3 Walls	Donated	Donation or Builders Warehouse
Water Proofing	To protect any exterior wood	1 L	325	Builders Warehouse
Wood Glue	To fill in the gaps left by some screws	1 bottle	108	Builders Warehouse
Timberlok Screws (4mm X 75mm) and (6.0mm X120mm)	To screw in the brackets to the posts	2 Boxes (120)	440	Builders Warehouse
Screws (4.2mm x 45mm)	To fasten loose bamboo to the frame	1 box (600)	510	Builders Warehouse
Tools	To screw and cut	1 Screw Gun, 1 Saw (Preferably electric)	Donation	Happinest
FillaFoam	To fill gaps in the bamboo	1 can	150	Builders Warehouse
Polycarbonate Sheets	Roof Material	3 sheets	747	Builders Wharehouse

4.3.3 Communication Poster

From the interviews, it was determined that a communication poster would be the most beneficial tool to aid the students on the playground. This tool acts as a way for the students to communicate what activity they want to do during playtime by pointing and looking.

We implemented a poster board showing pictures of each area of the Chaeli Cottage playground (Figure 28). We took photos of each piece of playground equipment at Chaeli Cottage, printed them out, and attached them to a poster board. The photos were laminated, and the poster was hung on the wall of the school building next to the door.



Figure 28: Communication Poster

On the poster, the name of each playground equipment appears on the picture so that the students may learn the words associated with the picture. The staff will be able to determine what the students want to do during playtime, and the students will be able to communicate their thoughts and have more exposure to the vocabulary.

Summary

The overarching accomplishment of our project was the addition of inclusive and accessible playground elements that allow all children, regardless of their disability, to play among their peers. It is also important to note that this was achieved using accessible elements that are invisible to allow all children to feel equally welcome. Examples of these accessible and invisible elements are the width of the doorway and the sand table.

The implications of this project are the long-term inclusion of all children at Chaeli Cottage as well as a change in how children with disabilities are viewed. A major limitation that arose throughout our project was the sample of students and disabilities that our design was tailored to. With a larger population of students at Chaeli Cottage, a larger variety of differences and accommodations could have been observed and considered. The future study from this project can focus on incorporating more disabilities into the design of inclusive playground equipment.

Chapter 5: Conclusions and Recommendations

Currently, in South Africa, children with disabilities face many obstacles in accessing a proper education due to the lack of inclusion and support provided to them. Playgrounds specifically are a crucial part of children's education. These spaces are one of the areas within the educational system that are not inclusive enough to provide quality education.

The goal of this project was to adapt a playground to be more inclusive to preschool children of all abilities at Chaeli Cottage to further the educational and outreach purposes of the school. By creating accessible spaces, we can promote and teach inclusivity among the students at Chaeli Cottage. Our team used invisible accessible elements within universal design to create a safe space that allows students with disabilities to feel welcome.

We achieved this goal by creating two accessible additions to the existing playground: a playhouse and a communication poster. Both elements were designed to promote interaction among peers as well as accommodate the needs of all the students at Chaeli Cottage. The communication poster was created as a tool for students with speech difficulties to aid them in communication on the playground. The playhouse was created to be large enough for students in wheelchairs to move freely, as well as provide sensory activities all students could participate in.

To continue promoting the goal of inclusivity in the future, our team gathered funds for The Chaeli Campaign to alleviate the day-to-day financial pressure they are currently under. This allows the organization to strategize to raise and use longer-term funds to promote its main mission of inclusivity.

The Chaeli Cottage playground already had a few accessible and inclusive elements, however, there were a couple of areas that needed improvement. Specifically, students in wheelchairs and with visual impairments were often excluded from play. On the other hand, the Chaeli Campaign was experiencing major financial concerns that required some extra support.

Limitations to our project include the number of disabilities present at Chaeli Cottage. While there is a variety of disabilities and differences at Chaeli Cottage, there are many disabilities that are not accounted for at the school. The project was focused on creating an inclusive space for the students currently enrolled at the school. This makes it more difficult to replicate this design in other spaces, as the design isn't directly tailored to their needs. Another major limitation our team faced throughout our project was the lack of workers to

help with our building process as well as our limited knowledge of the building process going into this project. Our team utilized our resources to quickly learn these skills to create a safe and durable product.

The implications of this project are the long-term inclusivity of all children at Chaeli Cottage as well as a change in how children with disabilities are viewed. With research focused on a larger variety of differences and accommodations, the playhouse could be created to fit all disabilities. The future study from this project can focus on incorporating more disabilities into the design of inclusive playground equipment.

Recommendations

Based on our findings, we recommend that **Chaeli Cottage** include the following in future additions to the playhouse:

- *Multiple heights to the sand table:* Therapists requested that there be multiple heights of the sand table to allow play for all students.
- *Additional sensory activities:* As the sample of students at Chaeli Cottage changes, it will be beneficial to the students to change the sensory activities to those that are tailored towards their wants and needs.

We recommend that the following methods are included in the **replication of the playhouse:**

- *Observing a larger sample size:* To make this design inclusive to a wider range of disabilities, the process for replicating the playhouse could be what we outlined throughout our report with a larger sample size.
- *Focus the design on the available sample of people:* If observing a larger sample size is not possible, it is important to focus the design on the specific needs of the users that the design is being made for.
- *Use donated and recycled materials:* Due to the budget for the final playhouse, we recommend using donated and recycled materials to replicate the playhouse for areas that don't have that money available.

We recommend that the following checks are completed periodically to **ensure safety in the playhouse:**

- *Sanding of the wood once a year:* This is to ensure there is no loose wood that can cause splinters or other injuries to students.
- *Security of activities once every three months:* This is to ensure that the sensory activities remain attached to the playhouse.
- *Clean the sand table once a year:* This is to ensure that the sand table retains its waterproofing quality and isn't deteriorating.
- *Checking the supports of the sand table once a year:* This is to ensure that the weight of the sand table is continuously supported over time.

- *Inspection for sharp objects twice a year:* This is to ensure that there are no sharp objects in the playhouse that can cause injuries to students.
- *Check for broken bamboo twice a year:* This is to ensure that the bamboo siding remains intact.
- *Clean the roof once every three months:* This is to ensure that there is no debris on the roof as the roof was not created to hold weight.

“True inclusion cannot be learnt- it needs to be lived” (The Chaeli Campaign, 2022).

By providing these children with an inclusive play space, Chaeli Cottage is teaching them and their peers that people with disabilities are valuable and capable. The project can also serve as a prototype that can be implemented in other early childhood development centers across the country, expanding The Chaeli Campaign’s mission and allowing society to live inclusively.

References

- Berg, B. L., (2007). *Qualitative Research Methods for the Social Sciences*. Pearson.
- Boundless Playgrounds. (2022). *Changing The Present*. Boundless Playgrounds.
<https://changingthepresent.org/collections/boundless-playgrounds>
- Burke, J.. (2013). Just for the fun of it: making playgrounds accessible to all children. *World Leisure Journal*, <https://doi.org/10.1080/04419057.2012.759144>
- Chaeli Cottage Pre-School. (2021). *Chaeli's Cottage Pre-School*. Chaeli's Campaign.
<https://chaelicampaign.org/chaeli-cottage-pre-school/>
- Dalton, E. M., Mckenzie, J. A., & Kahonde, C. (2012). The implementation of inclusive education in South Africa: reflections arising from a workshop for teachers and therapists to introduce universal design for learning. *African Journal of Disability*, (1), 7. <https://doi.org/10.4102/ajod.v1i1.13>
<https://doi.org/10.1097/TA.0b013e3181ac1400>
- Dyer, J., Middlemiss, L., & Thew, H. (2021). Towards just and inclusive community sustainability initiatives: learning from the mixed ability movement. *Justice Spatiale-Spatial Justice*, 16, Article 16. <https://www.jssj.org/article/vers-des-initiatives-communautaires-de-durabilite-justes-et-inclusives-tirer-des-lecons-du-mouvement-mixed-ability/>
- Inclusive Education and its Benefits. (n.d.). *New Brunswick Association For Community Living (NBACL)*. Retrieved September 15, 2022, from <https://nbacl.nb.ca/module-pages/inclusive-education-and-its-benefits/Home>.
- Chaeli Campaign. (2022, December 14). Retrieved December 15, 2022, from <https://chaelicampaign.org/>
- Martin-Denham, S. (2022). Maginalisation, autism and school exclusion: caregivers' perspectives. *Support for Learning*, Vol. 37. (1), p. 108-143.
<https://doi.org/10.1111/1467-9604.12398>
- Moore, A., & Lynch, H. (2015). Accessibility and usability of playground environments for children under 12: A scoping review. *Scandinavian Journal of Occupational Therapy*, 22(5), 331–344. <https://doi.org/10.3109/11038128.2015.1049549>
- Prellwitz, M., & Skär, L. (200&). Usability of playgrounds for children with different abilities. *Occupational Therapy International*. 14(3):144-55.
<https://doi.org/10.1002/oti.23>

- Refshauge, A. D., Stigsdotter, U. K., Lamm, B., & Thorleifsdottir, K. (2013). Evidence-Based Playground Design: Lessons Learned from Theory to Practice. *Landscape Research*, 40(2), 226–246. <https://doi.org/10.1080/01426397.2013.824073>
- Scott, L. A. (2018a). Barriers With Implementing a Universal Design for Learning Framework. *Inclusion*, 6(4), 274–286. <https://doi.org/10.1352/2326-6988-6.4.274>
- Scott, L. A. (2018b). Barriers With Implementing a Universal Design for Learning Framework. *Inclusion*, 6(4), 274–286. <https://doi.org/10.1352/2326-6988-6.4.274>
- Spencer, K. H., & Wright, P. M. (2014). Toddlers and Preschool: Quality Outdoor Play Spaces for Young Children. *YC Young Children*, 69(5), 28–35. <http://www.jstor.org/stable/ycyoungchildren.69.5.28>
- Stanton-Chapman, T. L., & Schmidt, E. L. (2016). Special education professionals' perceptions toward accessible playgrounds. *Sage Journals*. <https://doi.org/10.1177/1540796916638499>
- Stanton-Chapman, T. L., & Schmidt, E. L. (2017). Caregiver perceptions of inclusive playgrounds targeting toddlers and preschoolers with disabilities: Has recent international and national policy improved overall satisfaction? *Journal of Research in Special Educational Needs*, 17(4), 237–246. <https://doi.org/10.1111/1471-3802.12381>
- Stanton-Chapman, T. L., & Schmidt, E. L. (2019). Building playgrounds for children of all abilities: legal requirements and professional recommendations. *Early Childhood Education Journal*, 47(5), 509–517. <https://doi.org/10.1007/s10643-019-00947-3>
- Stats SA Profiles Persons with Disabilities. (2014). [Government]. Stats SA Profiles Persons with Disabilities. <https://www.statssa.gov.za/?p=3180> <https://cecd.org.za/wp-content/uploads/2020/01/cecd-research-report-low-res.pdf>
- THE 17 GOALS | Sustainable Development. (n.d.), United Nations. <https://sdgs.un.org/goals>
- “The 7 Principles of Universal Design .” *Centre for Excellence in Universal Design*, (2020). National Disability Authority, <https://universaldesign.ie/what-is-universal-design/the-7-principles/>.
- Woolley, H., & Lowe, A. (2013, February 1). [pdf] *exploring the relationship between design approach and play value of outdoor play spaces: Semantic scholar*. Retrieved December 15, 2022, from <https://www.tandfonline.com/doi/abs/10.1080/01426397.2011.640432>
- World Health Organization. (2022). *Disability*. World Health Organization. Retrieved

December 15, 2022, from

<https://www.who.int/news-room/fact-sheets/detail/disability-and-health>

Appendices

Appendix A List of Interviewees

Table 4: List of Interviewees

Interviewee	Professional Title	Date of Interview
Rosemary Luger	Occupational Therapist, Director of Therapies	10/31/2022
Ann Bullen	Physio Therapist	11/1/2022
Debbie Prudhomme	Principal	11/8/2022
Ariska Prins	Teacher	11/8/2022
Chaeli Mycroft	Manager of Relations and Funds	10/31/2022
Faziah Toefy	Speech Therapist	11/3/2022

Appendix B Interview Questions Set for Professional Staff at Chaeli Cottage

Semi-structured interviews with professional staff will be conducted informally and conversationally. Key questions include:

1. What equipment and activities on the playground do you believe are promoting growth and development for the students?
2. What equipment and activities do you believe are creating exclusion for the students?
3. What skills do the students need more specific practice with to develop their educational, social, and cognitive skills?
4. What safety concerns do you have with the current playground?
5. What additional support is needed on the existing playground?
6. Do you have any ideas or specific wants in a new playground?

Appendix C Interview Questions Set for Manager of Relations and Funds

Semi-structured interviews with the Manager of Relations and Funds at The Chaeli Campaign will be conducted informally and conversationally. Key questions include:

1. What is The Chaeli Campaign's main method for getting funds?
2. Does The Chaeli Campaign currently subscribe to a grant database?
3. Do you have an expense list of all the consumable items The Chaeli Campaign and Chaeli Cottage use monthly that we could reference? Who is the point of contact for this?
4. Do you know of any organizations/online sources that make registries?

Appendix D Table of Responses from Interviews

Table 5: Table of Responses from Interviews

What equipment and activities are currently promoting growth and development for students?	What equipment and activities are creating exclusion among students?	What safety concerns do you have with the current playground?
Sensory activities	Existing playhouse	Sharp, loose objects
Sensory activities	Existing playhouse	Equipment made of untreated wood
Inclusive activities	Swing set	X
Play Kitchen	Sandpit, existing playhouse	Equipment made of untreated wood
Equipment that allows for eye-level play between peers	Sandpit	X

Appendix E Registry Spreadsheet

Table 6: Registry Spreadsheet

Items in Need	Cost (ZAR)	Cost (USD)
Pre-school Stationary/Art Kits	500	\$28.99
Inclusive Dance Workshop (1.5 hours)	1000	\$57.97
Ambassador Workshop	2000	\$115.94
5 Meals for a Child in Need	200	\$11.59
1 month's School Fees at Chaeli Cottage	4000	\$231.88
Photocopy Paper	900	\$52.17
Black Pens	218	\$12.64
Pritt Glue Sticks	460	\$26.67
Dish Cloths	120	\$6.96
Hand Soap	300	\$17.39
Dishwashing Liquid	568	\$32.93
Zim Sponges	440	\$25.51
Nescafe Refills (coffee)	500	\$28.99
Sugar	300	\$17.39
Milk	400	\$23.19
Longlife Milk	260	\$15.07
Roses Tea	100	\$5.80
Rooibos Tea	160	\$9.28
Biscuits	1000	\$57.97
Handy Andy (All Purpose Cleaner)	280	\$16.23
Jiks (bleach)	260	\$15.07
Toilet Paper	1000	\$57.97
Toilet Cleaner	800	\$46.38

Maintenance Guide for the Chaeli Cottage Playhouse Built December 2022

By: Amanda, Henry, Kayla, and Nick



Figure 29: Picture of the Playhouse

Maintenance of the Playhouse

We designed the playhouse so that it would need very little maintenance but we have included possible solutions to three problems that could take place.

- If a piece of bamboo breaks so much that it is not safe for kids there are two options you can do to fix it. To replace the bamboo, pull out the nails and unscrew the screws. Then take off the piece of bamboo that it broke.
 - The first option is to replace it with bamboo from Builders Warehouse which involves cutting and sanding the piece to size and screwing it back into the wall.
 - The second option is leaving it off of the wall as that will not take away from the structural integrity and the large gap would just make it easier to see into the playhouse.
- If the sensory items fall off, you can choose to screw them in again or attach them in whatever way would be most beneficial to the user.
- If the roof breaks then unscrew the screws and replace the section of the roof that broke with the polycarbonate sheets that are found in the list of resources.

Maintenance Recommendations

We recommend that the following checks are completed periodically to ensure safety in the playhouse:

- *Sanding of the wood once a year:* This is to ensure there is no loose wood that can cause splinters or other injuries to students.
- *Security of activities once every three months:* This is to ensure that the sensory activities remain attached to the playhouse.
- *Clean the sand table once a year:* This is to ensure that the sand table retains its waterproofing quality and isn't deteriorating.
- *Checking the supports of the sand table once a year:* This is to ensure that the weight of the sand table is continuously supported over time.
- *Inspection for sharp objects twice a year:* This is to ensure that there are no sharp objects in the playhouse that can cause injuries to students.
- *Check for broken bamboo twice a year:* This is to ensure that the bamboo siding remains intact.
- *Clean the roof once every three months:* This is to ensure that there is no debris on the roof as the roof was not created to hold weight.

Future Additions

Based on our findings, we recommend that Chaeli Cottage include the following in future additions to the playhouse:

- *Multiple heights to the sand table:* Therapists requested that there be multiple heights of the sand table to allow play for all students.

- *Additional sensory activities:* As the sample of students at Chaeli Cottage changes, it will be beneficial to the students to change the sensory activities to those that are tailored towards their wants and needs.
- *Bring sensory items further off of the wall:* This would allow for better access to these items for children who use wheelchairs and would allow them to face the activity that they are using instead of having to play from the side.

List of Resources

Table 7: List of Resources for The Playhouse

Item	Purpose	Amount Needed	Cost (ZAR)	Cost (USD)	Supplier
South African Pine Laminated Beams and Posts	Corner Posts/Supports 70 mm x 70 mm x 2.4 m	16	3,120.00	\$180.87	Somerset Timbers
Water Resistant Particle Board (1200mm x 2400mm)	Sand Table	1	760.00	\$44.06	Somerset Timbers
Bamboo (1500mm x 2000mm)	Siding	3	Donated	N/A	Happinest
Water Proofing Cover, Exterior Wood Care Preservative by Plascon	Sand Table	1	325.00	\$18.84	Builders Warehouse
Screws (4.2mm X 45mm)	General	---	510.00	\$29.57	Builders Warehouse
Screws (6.0mm X 120mm)	General	60	235.00	\$13.62	Builders Warehouse
Chalkboard	Sensory Game	1	Donated	N/a	N/a
Velcro	Poster	1 pack	Donated	N/a	N/a
PVC Piping	Sensory Game	3	177.00	\$10.26	Builders Warehouse
Talking Tube PVC	Sensory Game	3	237.00	\$13.74	Builders Warehouse
Wood Abacus	Sensory Game	1	194.00	\$11.25	Mambo's
Flat Abacus	Sensory Game	1	79.00	\$4.58	Mambo's
Roof Material Polycarbonate Sheets	Roof	3	747.00	\$43.30	Builders Warehouse
Wood Glue	General	1	145.00	\$8.41	Builders Warehouse
Floor Lamp Button (Doorbell)	Sensory Activity	1	79.00	\$4.58	Builders Warehouse
Filla Foam	General	1	187.00	\$10.84	Builders Warehouse
Planter Box	Planter	1	139.00	\$8.06	Builders Warehouse
Screws (4mm X 75mm)	General	150	205.00	\$11.88	Builders Warehouse
		Total Calculated Cost	7,139.00	\$413.86	

CAD Model

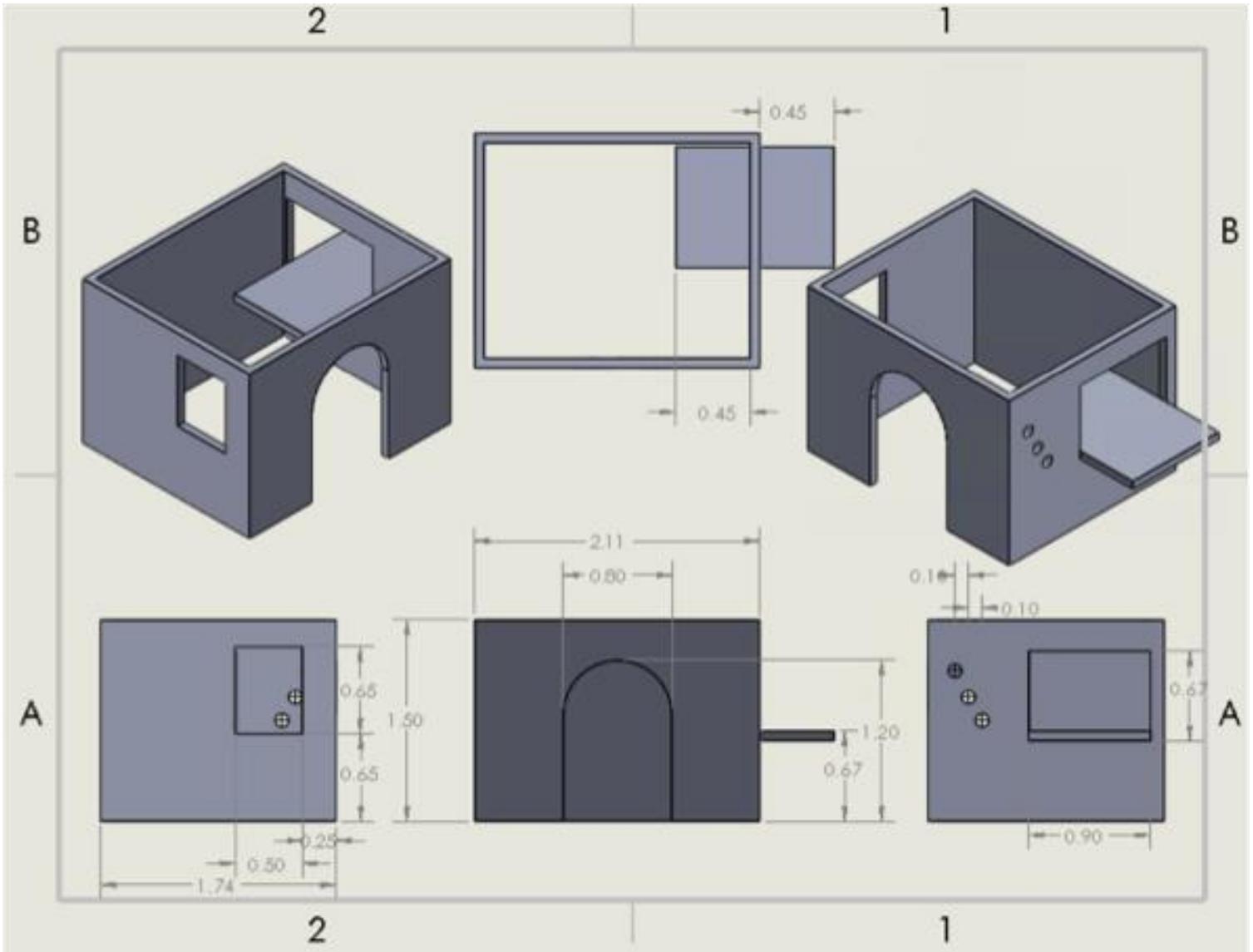


Figure 30: CAD Rendering of Playhouse

Hand Drawings

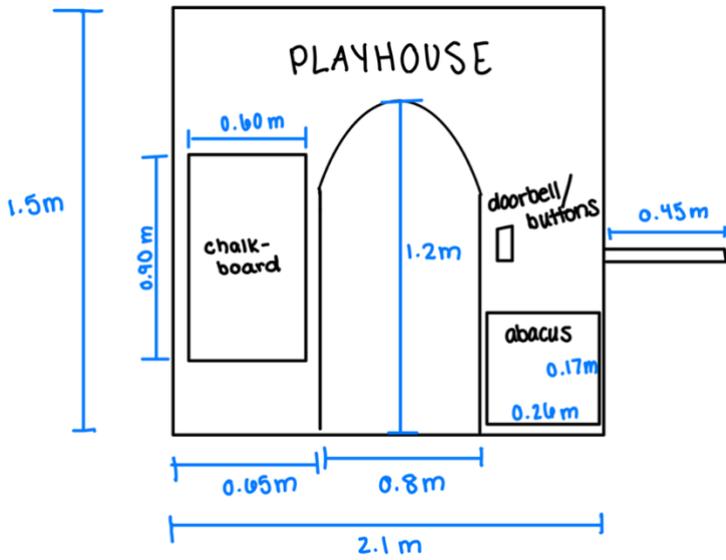


Figure 32: Drawing of Front Outside of Playhouse

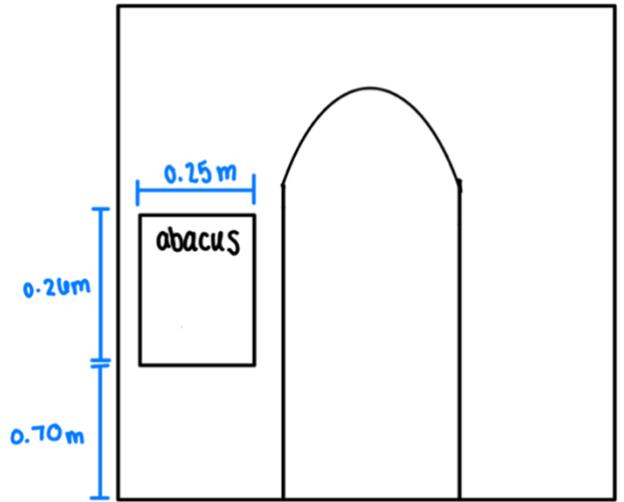


Figure 31: Drawing of Front Interior of Playhouse

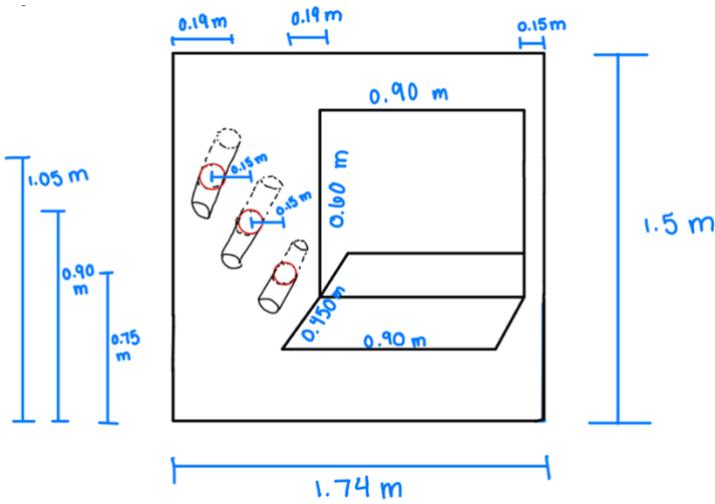


Figure 34: Drawing of Right Outside of Playhouse

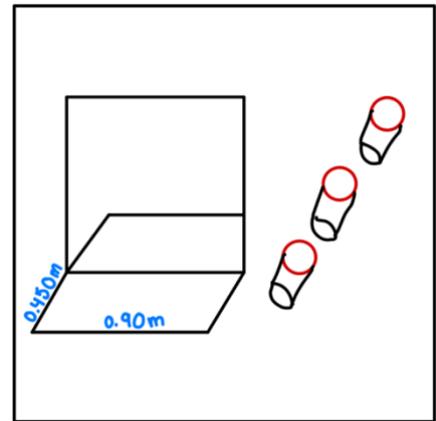


Figure 33: Drawing of Right Interior of Playhouse

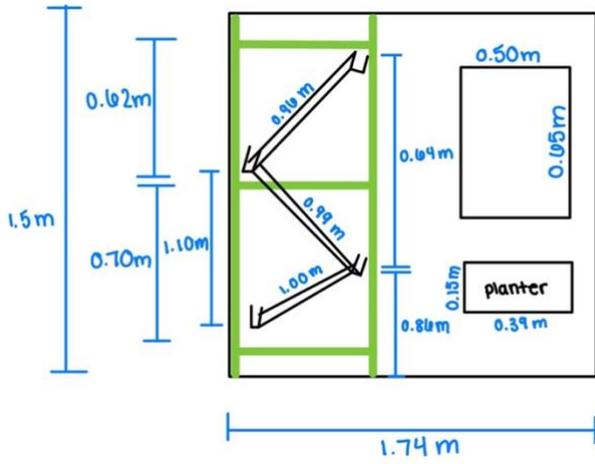


Figure 36: Drawing of Left Outside of Playhouse

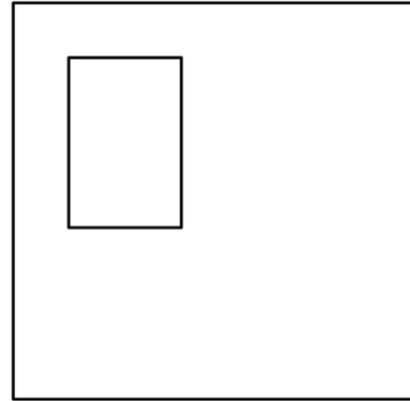


Figure 35: Drawing of Left Interior of Playhouse